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## CONTENTS.

An Asterisk (*) denotes an illustrated article.


OFFICIAL NOTICE—
Twentieth Annual Meeting of the American Gas Light Association 505

EDITORIALS—
Briefly Told ..... 506
Hints as to the Boston Meeting—Changes in the Executive Management of the American Meter Company—The Incandescent Electric Lamp Decision.
President Irving's Address before the Southwest of England District Association of Gas Managers ..... 507
How Electricity is Measured, by Mr. H. L. Webb ..... 510
One-Horse Power to Four Feet of Heating Surface ..... 511
Carbonizing Methods, Past and Present, by Mr. W. J. Carpenter ... 512
The Manufacture of Vitrified Sewer Pipe ..... 513
ITEMS OF INTEREST FROM VARIOUS LOCALITIES ..... 514
Twenty, not Ten-inch Mains at Worcester, Mass.—Tar Imports from England—New Water Gas Plant for the Nassau Company, Brooklyn, N. Y.—Suing a Telegraph and Telephone Co.—A Bill to Regulate the Supply of Electric Currents, Canada—Hints from Columbus, Ind.—Barton Heights (Va.) Wants Gas—Cheaper Gas for Norwich, Conn.—The Amherst (Mass.) Gas Company and the Selectmen—Mr. H. S. Jackson on the Value of Gas Securities—Public Lighting, Muskegon, Mich.—Improving the Gas Supply of Haverstraw, N.Y.—Suits for Damages Settled, at Worcester, Mass—Something about the Consumers' Company, of Reading, Mass.—And Many Other Items.
The Production of Heating Gas and Ammonia ..... 517
The Market for Gas Securities ..... 518


[OFFICIAL NOTICE.]

### Twentieth Annual Meeting of the American Gas Light Association.

*Extract from the Constitution.*—"Sec. 12. Application for Active Membership or for Associate Membership, or for transfer from Associate to Active Membership, must be received by the Secretary at least ten days prior to the meeting at which the application is acted on."

*General Announcement.*

The twentieth annual meeting of the American Gas Light Association will be held in Boston on October 19th, 20th and 21st. The headquarters will be at the Parker House, in School street. The members will be called to order on the morning of Wednesday, Oct. 19th, at 10 o'clock, by the President, Wm. Henry White, Esq.

The following papers are promised:

1. "The Relation of Theory to Practice," by Alex. C. Humphreys, Philadelphia, Pa.
2. "Water Gas Condensation," by John M. Rusby, Jersey City, N.J.
3. "A Gas Association and its Members," by Walter R. Addicks, Boston, Mass.
4. "Saving and Proper Concentration of Ammoniacal Liquor," by George Osius, Detroit, Mich.
5. "Anthracites of the United States," by C. R. Collins.
6. "Some Experiences as to the Best Burner for a Mixture of Coal and Water Gases in about Equal Proportions," by Alfred E. Forstall.
7. "Do Small Gas Companies Need Consulting Engineers," by Clem. A. White.
8. "Mechanical Handling of Coke" (partly promised).

It will be seen that we have but few papers this year, which is owing to the late withdrawal of some of those promised, although much effort has been made to secure others. This leaves plenty of opportunity for developing the possibilities of the question box, and it is hoped that the members will take advantage of it to bring up before the Association the discussion of many valuable points which may not be touched upon by or included in the subjects of the papers.

Members are specially urged to send to the Secretary *in advance* all questions which they would like to hear discussed in the meeting.

The meetings of the Association will be held in Pierce Hall, corner Huntington avenue and Dartmouth street.

The attention of the members is called to the bulletin board, which will be placed in lobby of Parker House. Notices in regard to the meeting, and especially changes in and additions to the printed programme, will be posted thereon, and it will, therefore, be well for the members to consult it from time to time.

As much valuable time is usually lost in calling the roll, and as but an inaccurate list is thus obtained of the members present, it is proposed this year to follow the same method as at the last two meetings, by having the members hand in their names to an attendant as they enter the meeting room for the *first time*. A special blank card has been adopted for this purpose, and these cards with pencils will be handed to members outside the hall door. Members will please write thereon their names and post office addresses.

The Committee of Arrangements is providing for the entertainment of the members during the time that they are not occupied with the business, which is the prime object of the meeting. The pleasure of the ladies will, as usual, be carefully provided for. The Secretary is able to announce a banquet to be tendered the members by the local Gas Companies, on the evening of Thursday, the 20th, at the Hotel Vendome. The Committee have also arranged for a harbor trip on Friday, October 22d. Steamer Nantasket will leave Rowe's Wharf at 10:30 A.M. for a trip about picturesque and historic Boston Harbor, returning at 2 P.M., in time for the afternoon trains west and south. Luncheon will be provided on board.

Members wishing to provide for comfortable hotel accommodations should remember that Boston is full of visitors at the time selected for this meeting, and, therefore, they should engage rooms well in advance. The Parker House and Young's, under the same management, are but a few steps apart, and rooms on the European plan may be secured at from $1.50 to $2.50 (with bath), to $6, and like terms at the Victoria, which is about two blocks from the meeting hall, and several other first-class houses. The Parker House will not be able to accommodate all the members, and, therefore, for the information of those not familiar with Boston, the following hotels, all fairly convenient to the headquarters, are mentioned: The Adams House (European plan, $1 to $5), Hotel Reynolds (European plan, $1 to $6); Vendome (American plan, $4); Quincy House (American plan, $3 to $5); and the Copley Square and Thorndyke, both on American and European plans. There are many others within convenient distance. The Committee announces that no special rates can be obtained at any of these houses; the regular rates vary, and some of the members may prefer to correspond with a number of these houses before selecting. Each of the houses named will afford thoroughly comfortable accommodations.

The Secretary also announces that the Council will recommend to the Association that Section 41 of the Constitution be amended by adding the following words: "and all parliamentary procedure not specifically covered by this Constitution shall be governed in accordance with 'Roberts' Rules of Order.'"

The Secretary respectfully calls to the attention of those whom it may concern part of Section 52, which reads: "Any member whose dues shall remain unpaid for a term of three years may be dropped from the roll of membership by a vote of the Council."

The Secretary is sorry to find that unless the payments received between now and the time of meeting render it unnecessary, he will be obliged to report to the Council a number of names that he feels sure are only on the list through inadvertence on the part of the members.

Dues are payable in advance. If not already attended to, will the members please remit for their dues *before laying this circular aside?*

*Transportation.*

The following passenger Associations have granted the usual concession in railroad rates, namely:

The Trunk Line Association, composed of the following railroads: Addison & Pennsylvania; Allegheny Valley; Baltimore & Ohio (Parkersburg, Bellaire and Wheeling, and east thereof); Baltimore & Potomac; *Bennington & Rutland; Buffalo, Rochester & Pittsburgh; Camden & Atlantic; Central of New Jersey; *Central Vermont; Chesapeake & Ohio (east of Charleston, W. Va.); Cumberland Valley; Delaware & Hudson Canal Co.; Delaware, Lackawanna & Western; Elmira, Cortland & Northern; Fall Brook Coal Co.; *Fitchburg; Fonda, Johnstown & Gloversville; *Grand Trunk; Lehigh Valley; New York Central & Hudson River; New York, Lake Erie & Western (east of Salamanca, Dunkirk and Buffalo); New York, Ontario & Western; New York, Philadelphia & Norfolk; Northern Central; Pennsylvania; Philadelphia & Erie; Philadelphia & Reading; Philadelphia, Wilmington & Baltimore; Rome, Watertown & Ogdensburg; Western New York & Pennsylvania; West Jersey; West Shore; Wilmington & Northern.

The New York and Boston lines, between the two places named, viz.: Boston & Albany Railroad; Fitchburg Railroad; New York & New England Railroad; New York, New Haven & Hartford Railroad; New York, Providence & Boston Railroad; Old Colony Railroad; Fall River Line; Norwich Line; Providence Line; Stonington Line.

The Southern Passenger Association, composed of the following companies: Alabama Great Southern; Atlantic Coast; Atlanta & West Point; Brunswick & Western; Charleston & Savannah; Central Railroad of Georgia; Cincinnati, New Orleans & Texas Pacific; East Tennessee, Virginia & Georgia; Georgia Railroad; Georgia Pacific; Illinois Central (lines south of the Ohio river); Jacksonville, Tampa & Key West; Louisville & Nashville (lines south of the Ohio river); Louisville, New Orleans & Texas; Mississippi & Tennessee; Mobile & Ohio (lines south of the Ohio river); Memphis & Charleston; Nashville, Chattanooga & St. Louis; New Orleans & Northeastern; Norfolk & Western; Pennsylvania Railroad (lines south of Washington); Port Royal & Augusta; Raleigh & Gaston; Richmond & Allegheny; Richmond & Danville; Richmond, Fredericks & Potomac; Rome Railroad; Savannah, Florida & Western; Seaboard & Roanoke; Shenandoah Valley (lines south of Potomac river); South Carolina Railway; Vicksburgh & Meridian; Western & Atlantic; Western Railway of Alabama.

The Central Traffic Association, covering the following ground: Bounded on the east by Pittsburgh, Salamanca, Buffalo, and Toronto; on the north by the line of and including points on the Grand Trunk Railway, from Toronto to Port Huron; thence via Lakes Huron and Michigan to the north line of Cook County, Illinois; on the west by the west line of Cook County and the Illinois and Mississippi rivers, to Cairo, including Burlington, Keokuk, Quincy, Hannibal and St. Louis; and on the south by the Ohio river, but including points on either side of that river.

The Western Passenger Association, covering territory west of Chicago and St. Louis, *decline* to grant any concession on account of the probable limited attendance from this territory. Members interested are referred to the fifth rule below, under which they can secure special rates from Chicago and St. Louis. (The Chicago & Alton Railroad, operating in this territory, individually grants concession as herein described from all points in Illonois to Chicago or Bloomington.)

The usual concession in railroad rates has been granted, namely, one-third off on the round trip. That is, members will pay full fare going, obtain a certificate from the ticket agent from whom they purchase their tickets, and, upon presentation of this certificate at Boston, duly endorsed by the Secretary, they can obtain the return ticket at one-third the full fare rate. To illustrate: Suppose the regular fare from some point to Boston to be $30. At the time of purchasing his ticket to New York the member pays $30 and obtains the necessary certificate from the agent; he has that indorsed by the Secretary, at Boston; then, on presentation of the same to the ticket agent at Boston, he can procure a return ticket by payment of only $10.

The following extracts from the regulations of the railroads are cited for the information of the members. The special rates are granted subject to these regulations:

1st. The American Gas Light Association is obliged to guarantee to redeem at full fare rates any return tickets procured by persons in attendance at meeting which may afterwards be found in the hands of "scalpers."

2nd. The reduction is conditional on there being an attendance at the meeting of not less than 100 persons holding certificates.

3d. Each person, to obtain the excursion rate, must purchase a first-class ticket (either limited or unlimited) to the place of meeting, for which he will pay regular fare, and upon request, the ticket agent will issue a printed certificate of purchase of the standard form. Agents at all important stations are supplied with certificates.

4th. If through tickets cannot be procured at the starting point, purchase short-trip ticket to the most convenient point where such through tickets can be obtained, and there purchase through to place of meeting, requesting a certificate from the ticket agent at the point where second purchase is made.

5th. Tickets for the return journey will be sold by the ticket agents at the place of meeting at one-third the highest limited fare, only to those holding certificates signed by the ticket agent at point where through ticket to place of meeting was purchased, and countersigned by signature written in ink by the Secretary of the Association, certifying that the holder has been in regular attendance at the meeting.

6th. No reduction of fare will be made on the return passage if the going ticket is purchased more than three days before the opening date of the meeting; except that when meetings are held at distant points to which the authorized limit is greater than three days, tickets may be purchased before the meeting in accordance with the limits shown in regular tariffs.

7th. Certificates are not transferable, and return tickets secured upon certificates are not transferable.

8th. The certificate of agent at starting point, duly endorsed by the Secretary of Association, must be presented to ticket agent at the place of meeting, within three days (Sunday excepted) after adjournment of meeting. The return ticket will be for the line or lines covered by the going ticket.

9th. No refund of fare will be made on account of any person failing to obtain a certificate.

*Important.*—Be sure to obtain your railroad certificate when buying your ticket for Boston. Apply for ticket and certificate at least 30 minutes before train time. A separate certificate is necessary for each individual obtaining the reduced rate. Be sure to have the Secretary indorse your certificate at Boston. Apply for return ticket at least 30 minutes before train time, and have your certificate with you. Members will please hand their certificates to the Secretary, or his clerk, *upon arrival at the place of meeting.* If there are 100 members present, holding certificates, each certificate will then be properly indorsed and handed back to owner, before adjournment. Keep this circular in your pocket, and apply to it if you are in doubt.

Section 51. "No member who owes two years' dues shall be entitled to vote, or to participate in the deliberations of the Association, or to receive a copy of the proceedings."

This provision of the Constitution will be enforced at the coming meeting.

ALPHEUS B. SLATER, JR., Secretary.

PROVIDENCE, R. I., Sept. 12, 1892.

* Only for business originating at, or destined to, stations on the direct lines of these roads between Troy, N. Y., and Montreal, Canada.

## BRIEFLY TOLD.

HINTS AS TO THE BOSTON MEETING.—As this will be the last issue of the JOURNAL that will come to hand to all of our readers in America before the actual time set for the Boston meeting of the American Association, we again ask that all who propose to be present at the sessions will scan Secretary Slater's current circular closely, both for their convenience and comfort. Mr. Slater has been and is indefatigable in his work on behalf of the Association, and a like remark applies to the other executives, as also to the Committee of Arrangements. A feature of the work of the latter, and a very pleasant feature it is, is the naming of a Ladies' Local Committee, who are charged with the duty of overlooking the entertainment of the feminine guests of the Association. This special committee will have headquarters in Room 4, Parker House. Bulletin boards will be placed in the lobbies of the Parker House and Young's Hotel; also, of course, in Pierce Hall. The banquet will be at the Hotel Vendome, and it is announced that the hour for assembling thereat has been fixed for 7 P. M. of Thursday evening. The expectation is that a large attendance will reward the officers for the labor expended by them on the preliminaries.

CHANGES IN THE EXECUTIVE MANAGEMENT OF THE AMERICAN METER COMPANY.—The postponed annual meeting of the American Meter Company was brought off last week, and the result was considerable rearranging in the executive management of the Company. Mr. George J. McGourkey declined a re-election to the office of President, basing his declination on his unwillingness to undertake the positive cares of that office, being moved thereto, no doubt, by his recent severe illness, about all traces of which are now happily removed. The new President (who also retains his post as General Superintendent of the Company) is Mr. William N. Milsted, who has actually grown gray in the service, and whose elevation to the primal position in the Company is a just tribute to his skill and worth. Mr. W. H. Hopper succeeds to the Vice-Presidency, and Mr. Paul S. Merrifield assumes the duties of Secretary and Treasurer. Messrs. G. J. McGourkey and T. C. Hopper remain on the Board of Trustees, and each will, as in the past, give freely of their time to promote the interests of the Company they have so well served.

THE INCANDESCENT ELECTRIC LAMP DECISION.—The U. S. Circuit Court of Appeals for this district, Judge Wallace presiding, handed down a decision early last week in the long pending case of the Edison Electric Light Company against the U. S. Electric Lighting Company, which practically settles the sole right to manufacture and vend the ordinary incandescent electric lighting lamp in the Edison Company. The decision is a broad and sweeping one, and completely vindicates Mr. Edson's claim that he was the first to perfect and use a commercially successful lamp of the sort indicated.

## President Irving's Address Before the Southwest of England District Association of Gas Managers.

Gentlemen—I have to thank you for the very high honor you have conferred in electing me to be your President. I feel very conscious of the responsibilities pertaining to the office, and am fully mindful of the able and experienced men who have preceded me in this chair. It will, however, be my endeavor to follow, as far as I am able, their example in promoting, in whatever way I can, the real usefulness of this Association, as a technical and social combination.

In these days of multiplying Associations, Institutes, and well and ably conducted technical journals, in the one or other of which every new idea, plan, or discovery that is likely to be of use or interest to those engaged in the gas industry is at once produced, in a manner that does credit to the generosity and enterprise of those contributing to this supply of information, suggestion, and helpful criticism, the task of preparing an address that shall present to you any new plan or process, or yet to present old ones that have not become thoroughly threadbare, is a somewhat difficult matter.

It is usual, on such occasions as these, to "ring the changes" upon the Board of Trade Returns or Field's "Analysis," and note the growth of the industry, the immense amount of capital involved, or the great progress made in the manufacture of coal gas, as seen in the wide difference between gas holders built during the first ten or twenty, and the last ten years of this century. There has doubtless been great progress made during the latter part of this century, more especially in constructive engineering and in the chemical and commercial knowledge brought to bear upon the manufacture and administration of gas undertakings. Yet it must be admitted that there has not been during the past sixty years any fundamental change in the various appliances used in gas manufacture. The form of retort and arrangement of setting originated by Peckston at Westminster in 1816, with its five retorts set two above three, and heated with two or three furnaces, its mouthpieces, ascensions, dip pipes, and hydraulic main arrangement, are in all essential principles the same as are in use throughout the country at the present time, excepting the material of the retorts. Or take the original and ingenious arrangement of four dry purifiers having hydraulic center valves to work the purifiers consecutively, patented by John Malam in 1823, and it will be found that they have never been superseded, except, perhaps, with regard to the modification of the valve. Or take the gasholder designed, and I believe erected by the elder Clegg at Bristol in 1819. This holder was without counterbalance weights, and had a capacity of 43,000 cubic feet—the largest then existing; and yet, in its main features, excepting the telescoping, this holder will not materially differ from the 5½ million holder now in course of erection in the same town. There is just a fear that we, coming in as it were on the flood-tide of success, may delude ourselves as to our true position in regard to that success, and forget what is due to the originators and pioneers of the industry.

No one can look into the history of the period to which I have referred without being impressed with the little progress that has since been made in the main features and methods. Works have, of course, grown in magnitude; but size is merely a matter of comparison, and, in itself, is no merit whatever. After the industry had become fairly floated, or established by Peckston, Malam, Clegg, etc., I cannot but think that the monopoly enjoyed by the companies, and the entire absence of competition, where parliamentary powers were enjoyed, seem to have destroyed that "necessity" which we are told is the "mother of invention." The facility and ease with which the selling price of gas could be raised and maintained, could not be considered as unqualified advantage. Mr. Newbigging, with that frankness which is characteristic of him, makes bold to say that the apathy of those administering gas undertakings during a certain epoch was very apparent, because they failed or neglected to adopt improvements that had been successfully and clearly demonstrated. I have often heard the charge made that gas people were very conservative, and slow to move. It was only somewhat natural that companies, with a sense of their responsibilities to their shareholders and the general public, should hesitate to adopt every new-fangled method presented by enthusiastic inventors, especially when it is remembered that for years some companies were unable to earn a cent of dividend; yet it is difficult to account for the slow adoption, and even strong opposition, to decided improvements in manufacture, as, for instance, in the use of clay retorts in England, and especially in London, after their great advantage had been proved in the North again and again.

In a recent article published in the *Journal of Gas Lighting*, contributed by our esteemed Secretary,* the writer states that one cannot but express surprise, on looking for data on such topics as the effect of length of retort on the quantity or quality of the gas produced, the influence exerted by the weight of the charge, the sectional area or thickness of the retort, etc., to find that none are forthcoming, although coal has been carbonized in great quantities for many years. It seems to be generally taken for granted that all we have to do is to get it into the retorts, and to work it off dead. A general, but nevertheless vague, opinion in favor of high heats and short periods of charging, based upon the results of practical experience, together with the obvious deduction that the charge should not remain in the retort after it has been burned off, represents the sum of our knowledge on the important subject of carbonization. Murdoch is said to have experimented with retorts of various forms; but with what results I have been unable to ascertain.

There have been several departures made from the orthodox and stereotyped methods of carbonizing, which seem to have attempted more or less successfully to permanently volatilize the hydrocarbons usually condensed in the tar. Malam, at Dumfries, twenty years ago, succeeded in adding upwards of 3,000 cubic feet per ton to his make. The method was also extended to other works; and it failed only because he was unable to continuously remove the pitch. Mr. Isaac Carr, with the Dinsmore process at Widnes, seems to have been more successful; producing over 10,000 cubic feet of 19-candle gas from coal little better than common slack. All such investigations merit our warmest approval and admiration. Strange to say, they seldom receive even courteous criticism. There have always been wiseacres who, lacking the courage and application to strike out a new course or method, nevertheless are ever ready to criticize and discourage the works of others. Some of our greatest achievements are accomplished facts only because they fall into the hands of energetic and capable men. No greater misfortune could befall any probable improvement than that it should depend for its exemplification upon men who, otherwise capable, yet lack that devoted application, courage, and capacity to work and overcome detail that are so essential to success.

The attention now being given to inclined retorts in various parts of the country, cannot fail in the end to be productive of good. The idea of elevating the coal, and, by a series of gravitating movements bringing it to the ground again *as coke*, is excellent. The system is now in the hands of capable men, who may be depended upon to carry it through to a successful issue. Every additional trial of these retorts commences with the advantages gained from the experience of preceding installations. If various objections which have been raised against this system, and which are principally of a structural nature, can be overcome, I can see no reason why, in works that are adapted to it, it should not be economical and successful.

Mechanical stoking is undoubtedly making steady progress in the country. I need only refer to the published results obtained by Mr. Tysoe at the East Greenwich works of the South Metropolitan Gas Company, where, with West's power machines, coal is being carbonized at a cost of under 1s. per ton, including maintenance and repair. This is undoubtedly the best authenticated result hitherto obtained. Mr. Tysoe says, in a paper read before the Southern Association last year: "The case for machine stoking is not completed with a statement of the amount of reduction in the carbonizing wages. The subject of stopped pipes is always one of interest to gas managers; and a suggestion for the prevention of the evil is always eagerly investigated by those who are troubled with the complaint. The primary cause of stopped pipes is irregular or insufficient charging, together with irregular heating. If the middle of a through retort is at a proper temperature, and a due proportion is not deposited there, a stopped pipe is the almost inevitable result; or, if a smaller charge than the retort is capable of dealing with is put in, a like result may be anticipated. Both these conditions are easy of attainment under the hand system of charging; it being impossible to exercise supervision over each charge, and the men being anxious to get their allotted task over as quickly as possible, it is frequently performed in a slovenly manner. With the introduction of machinery, an entirely new state of things obtains. It becomes as easy to put in a full charge as a light one, and the driver cannot turn the scoop until it is right home in the retort; and thus a proper charge is guaranteed. The effect of this has been to greatly diminish the number of stopped pipes, and must be placed to the credit of machine stoking. In addition, great regularity in the illuminating power is maintained. * * * * Another point is gained by having the retorts open a much shorter time than is usual with hand work, which has an undoubted effect upon the yield of gas." Any mention of mechanical stoking that omitted to include the name of Mr. John West would be most incomplete; and I have no hesitation in saying that the general adoption and success of these machines is due to his indomitable energy and dogged

* Mr. Norton H. Humphrys, our special English correspondent.

determination, equally as much as to his inventive genius and mechanical skill.

There have also been great improvements in the methods of retort setting and heating. The application of regenerative furnaces introduced into this country some time ago, has not made that progress which was anticipated, and why this should be it is somewhat difficult to imagine. The system or principle is theoretically perfect, and the theory has been abundantly illustrated and proved in almost every part of the country. It is absolutely impossible by direct firing to consume coke in anything like a perfect manner. In ordinary work, two or three times the neces sary quantity of air to completely oxidize the fuel is passed into the furnace. This threefold quantity of air, with its enormous preponderance of diluent nitrogen, not only carries off a large amount of heat to the chimney stack, but it acts as an envelope of inert gas, preventing the proper oxidization of the fuel.

I do not contend that, by burning 12 parts by weight of carbon (C)—of the coke—with 16 of oxygen into 28 of carbonic oxide (CO), and afterwards burning this carbonic oxide with another 16 of oxygen, to form 44 of carbonic acid ($CO_2$), greater heat would be produced than if 12 of carbon were burned with 32 of oxygen direct to form the 44 of carbonic acid. But it is held that higher results would be obtained in the former case, because it would be accomplished with a minimum quantity of air and, of course, diluent nitrogen—just sufficient air being introduced to completely oxidize the carbon of the fuel. Again, with direct firing the products of combustion must of necessity leave the setting at the temperature of the retorts; while, on the other hand, regeneration recovers and restores a considerable portion of the heat thus lost. No better example of this fact need be quoted than that we have this day witnessed in the retort house of the Bournemouth gas works. The chimney stacks were, as you would notice, made of wrought iron, 18 inches diameter; the bottom end resting on the setting, and the upper end passing just through the roof, and yet so little heat escapes from the generators employed that these stacks are not red, even when seen at night.

By regeneration is not meant long and tortuous flues, because experience proves that these are unnecessary. The actual saving by the use of regenerative furnaces is from 10 to 30 per cent., compared with direct firing. The actual consumption of coke per 100 lbs. of coal carbonized must vary in accordance with the quality of the fuel used. With coke containing from 15 to 25 per cent. of ash—such as is sometimes met with in this district—it would be impossible to obtain the low results said to be secured in some works; still the proportionate saving will be the same whatever the class of fuel. There are, in addition, other marked advantages—the facility with which a properly constructed furnace can be cleaned, less wear and tear, and more uniform and regular heats, etc. Yet, with all these advantages in favor of gaseous or regenerative furnaces, advantages that have been confirmed in my own experience, these furnaces do not, in my opinion, receive the favor their merits warrant.

To obtain anything like a full measure of success with regenerators, there are a few essential points to be kept in view: First, the primary and secondary air should be kept under complete control. Second, the furnace gas and air should be well distributed throughout the setting, so as to secure, as far as possible, continuous combustion. Third, the furnace should be easy of access for cleaning, and worked regularly. Fourth, intelligent supervision is required. The exit flue from the seting should be convenient for inspection; and a little experience will enable any intelligent foreman or furnaceman to regulate the primary and secondary air so as to exactly balance; and the heat of the retorts themselves will at once show if there is any excess or insufficiency of furnace gas being produced, equally as well as, if not better than any chemical analysis. In some of our large works water gas plant has recently been introduced—not so much on economical grounds as of labor considerations. It is stated that a million cubic feet of 24-candle gas can be produced per day with five men per shift, and at a cost of 1s. 6d. per 1,000 cubic feet. Mr. A. G. Glasgow, who has had considerable experience in the manufacture of water gas in America and in this country, gives the following as the actual results obtained, I believe, at Beckton, with Lowe's improved plant—

| | |
|---|---|
| 40 lbs. of coke, at 15s. per ton | 3½d. |
| 3½ lbs. of oil | 11⅛ |
| Labor | 1½ |
| Purification material | ¼ |
| Repairs and maintenance | ¼ |
| Superintendence | ¼ |
| Total holder cost | 1s. 6d. |

The facility with which large quantities of rich gas can thus be produced, cannot fail to be of great advantage, especially in large works. Another advantage is that the apparatus can in a few hours be put into full working order; and gas of any desired quality, from 16 to 40 candles, can be produced. Oil has also been used with some success as a substitute for cannel; and there is Mr. Clark's process for the enrichment of gas in bulk, which will come before you to-day for discussion, and which, I am pleased to add, is becoming extensively adopted in some of our largest works.

Following the order of manufacture, the next thing to be considered is condensation. In the term "condensation" is included the treatment the gas receives in its course from the hydraulic main to the commencement of the apparatus for the removal of ammonia and other impurities. The proper degree of temperature to which gas should be reduced before entering the ammonia apparatus has never been determined with anything like accuracy—every one following the bent of his inclination or circumstances. It is not a matter of congratulation that a subject of so much importance should be left to rule of thumb, or no rule at all. In many cases, and in important works, it is thought sufficient to provide apparatus of ample capacity; and then condensation is left, through all the varying atmospheric conditions of our varying climate, to take care of itself. Newbigging, Bowditch, Young and others have made investigations upon this subject, and two or three general conclusions have been arrived at—first, that condensation should be gradual; second, that it should not be excessive; and, thirdly, that the gas and tar should not be allowed to travel together at temperatures below 100° or 120°. All atmospheric condensers are, to a large extent, at the mercy of the atmosphere; and for efficient and controllable condensation water condensers are to be preferred. The annular condenser at first found considerable favor; and now large foul mains running round the inside of the retort house, with an inclination to the hydraulic main, are advocated, and are being introduced with advantage into several works in the southwest district. This is one of the subjects which undoubtedly call for accurate investigation by gas engineers.

Where high heats are employed, great difficulty is often experienced in keeping ascension pipes and hydraulic mains clear. This may be due to too much or too little condensation in that part of the plant; generally it will be found due to the tar being practically distilled and the pitch deposited in the pipes and hydraulic mains. Taking off the tar, etc., from the under side, and regularly flushing and filling the hydraulic main with warm liquor, together with regular and even charges in the retorts, will generally be found to give relief, if it does not entirely remove the difficulty. With reference to the after-condensation, my own plan has been to have thermometers fixed at the inlet and outlet of condensers, scrubbers, washers and purifiers, which are all daily observed and recorded; and, as far as practicable, the gas is never allowed to fall below 55° or 60° F.

After the condensation is accomplished, there remains the ammonia, sulphureted hydrogen and other sulphur compounds and carbonic acid. The purification of gas has made undoubted progress of late years, and is now carried out with a scientific refinement unknown to any previous period. Yet our methods of accomplishing this purification cannot be considered anything but clumsy and extravagant. The preparation of the material, the filling, covering up, securing, and after a time again uncovering and digging out the material from the purifying vessel, is most unsatisfactory, and must sooner or later give place to some continuous and less laborious methods. The actual results obtained by our best methods of dry purification leave little room for complaint, as the purity of the gas supplied at most works is in every way satisfactory.

The cost of purification in the Metropolitan works is given by Field as 9.8d.; the Suburban Companies, at 7.13d.; Provincial Corporations, 4.69d.; and Provincial Companies, 7.13d. per ton of coals carbonized. So that the companies spend over 50 per cent. more than the corporations in the matter of purification, which shows that the private companies, at least, spare no cost in this respect.

The great ideal of gas engineers has for many years past been a continuous system of purification in closed vessels, wherein the sulphur compounds and carbonic acid will be removed with the same ease, and, let us hope, with the same amount of profit with which ammonia is now removed. Attempts have been made as far back as 1860 to use the ammoniacal liquor obtained for arresting the other impurities. The first contribution of Mr. George Livesey to the British Association of Gas Managers was upon this very subject, and will be found in the first volume of the "Transactions" of 1866. Laming and Hill have also made experiments in the same direction; but the most recent, and, I may add, the most hopeful experiment in this direction is that known as Claus's ammonia process. This may be simply described as a method of arresting the carbonic acid with ammonia, forming the carbonate, and the

sulphur as sulphide of ammonia, etc., and then, by a series of tower scrubbers, decarbonating and desulphurating the ammonia, or, as it may be expressed, revivifying it to be used over again—as it is well known we have only about one-sixth the theoretical quantity of ammonia necessary for arresting these impurities. The great beauty and advantage of the process is that the impurities can all be recovered in a marketable form. The surplus ammonia, being perfectly pure, can be used for making any of the salts of ammonia.

The amount of sulphur contained in gas made from west country coal will average about 14.08 lbs. per ton of coal. The proportion due to sulphureted hydrogen is 13.79 lbs., and that to the other sulphur compounds 0.29 lb. per ton of coal. These impurities can be removed in dry purifiers at a nominal cost; and in one works with which I am acquainted, the sulphur is removed and the carbon disulphide, etc., kept at an average of 10.71 grains per 100 cubic feet, with oxide alone, at a cost of under 1d. per ton, and if the oxygen or air process were in use, I have no doubt this cost would be considerably reduced. The removal of carbonic acid, which averages 3¼ per cent., in the same works costs over 4d. per ton of coal carbonized, and theoretically requires 3.94 cubic yards of lime for this purpose. Practically over 15 per cent. more than this quantity is used. To obtain the full duty of the ammonia produced in ordinary working, in the removal of sulphur and carbonic acid, it is necessary that the gas be kept in intimate and prolonged contact with the liquor; and the success of some of the washer-scrubbers recently introduced, is due to the fact that the liquor is retained in the apparatus for a considerable time, and thus becomes thoroughly saturated with these impurities.

With regard to the working up of residual products, the circumstances and surroundings of each particular works must decide. Where 1s. 8d. or 1s. 9d. per ton is being derived from ammoniacal liquor at the present time, it would obviously be unwise to manufacture sulphate or any of the other salts of ammonia. The manner in which some of our medium sized undertakings, and even small works in our own district, work up their residuals, affords striking evidence of the energy and technical knowledge being brought into play in modern gas manufacture. In our best conducted establishments, coke is carefully and scientifically employed, tar is distilled for its various products, limestone is burned and oxide of iron manufactured on the premises. The sulphur recovered in the process of purification is converted into sulphuric acid, the ammonia obtained is distilled, and together with the sulphuric acid is converted into sulphate of ammonia; and, in addition to this, in a works not a hundred miles from Swindon, patent fuel briquettes are made.

After the gas is manufactured, its careful and successful distribution is a further tax upon the energy of gas managers, and it is in this department where their tact and business capacity will be put to the most severe strain. In addition to the great vigilance and care necessary in the laying and maintenance of mains and services, experience has shown that too much attention cannot be given to consumers' meters, service pipes and the public lamps. With regard to meters, there is undoubtedly, on the part of the consumer, a preference for the dry meter, which, even when new, should never be fixed without testing, and no meter should run more than five years without being thoroughly examined and tested. When testing for capacity, the test for soundness should never in any case be omitted. The governors and burners of street lamps should also be periodically tested and regulated to the pressure and consumption pertaining to the district. The ignorance of the general public with regard to the proper method of burning coal gas, and the unfortunate state of many consumers' pipes and fittings, have naturally raised the question as to the desirability of controlling the consumers' gas supply. Excessive pressure, small and badly laid pipes and defective burners are unfortunately far too prevalent, and these all find expression in the complaints of the consumer as "bad gas."

Mr. Keillor recently called the attention of the North British Association of Gas Managers to the important position the meter inspector occupies, as being the representative of the company most in contact with the consumer, and he suggested, as a fifth "golden rule," that "the inspector should be a man of sound mind and judgment, thoroughly learned in the distribution of gas, and able to discuss, with consumers on the spot, everything connected with gas supply." And considering the recent development of cooking by gas, and the general adoption of gas engines, I would suggest that he should also be trained in the rudimentary laws of combustion, ventilation and mechanics, and that his pay should be in proportion to the standard thus adopted.

It is satisfactory to note the general activity that now pervades the gas industry. There never was a time when those engaged in the manufacture of coal gas were more alive to everything pertaining to improvement and economy; and I think it may be fairly claimed, that the various Associations have played a most important part in bringing about this condition. They have not only helped to carry forward the profession "in a line with the general progress around us," but have generally given the lead in every new advance. There is, however, one point upon which the Associations, and particularly the National Institute, seem to have failed in their duty—namely, in promoting technical education, by forming a Board of Examination for the purpose of examining students. Can it be considered creditable to a wealthy and influential industry that it should leave the examination of its rising young men to irresponsible outsiders like the City and Guilds of London Institute? If these examinations were under the auspices of the profession, by whom the Board would be elected, they would be more generally supported and valued. I would not like to be understood as saying one word to detract from the value of these examinations, or in the slightest degree to reflect upon those who conduct them. The examination stands alone as the best in existence, and, as such, commands some respect and gratitude from all interested in technical education. The *Journal of Gas Lighting*, which has always warmly supported the formation of an Examining Board, says: "We are desirous of aiding by this means the intelligent study of the principles of gas manufacture and distribution, so that the rising generation—the gas managers and engineers of the future—might rid themselves of the pernicious influence of routine, and, shaking off localisms and cramping traditions, might equip themselves with a stock of sound technical information." The fear that has been expressed in certain quarters that, because technical (or, as I should prefer to call it, exact) knowledge was encouraged, there was danger of ignoring energy, practical knowledge, and sound judgment, is absolutely groundless. Experience, judgment, and energy are qualities which it would be impossible to ignore in any walk of life; and they are absolutely necessary in this as in other professions.

In conclusion, gentlemen, there is just one matter to which I desire to call your special attention. We have now some nine District Associations, and two other Societies which aspire to national representation, all doing good and useful work, and yet having no connecting link or means of combination for the purposes of research, or for organizing the combined influence and opinion of those engaged in this great industry. There is a wide field of investigation yet lying fallow. There are problems unsolved in carbonizing, purifying, and distribution; and the industry is entering upon a phase of its existence to which it has hitherto been a stranger. For years we have rested secure in the monopoly guaranteed by Parliament, satisfied and contented if but our standard dividends were paid. But now other competitors are in the field, backed by wealth and science; and the race will be determined, to a very great extent, by the respective cost and efficiency of the competitors. Would it not be a great advantage in this competition if the various isolated Associations were federated into one grand Institute or Institution, having sectional divisions or district branches? The objects of each Association are the same; and are set forth by each one in almost identical language—namely, to promote the advancement of the industry in its various branches of "engineering, manufacture, and finance;" and the only difficulty that stands in the way of such a consummation, as far as I can ascertain after inquiry, is the nominal position to be occupied by certain gentlemen, whose honor, attainments, and experience are not questioned, but whose connections with trading concerns are considered to debar them, not from associating with (because that is accorded by every one of the societies without exception), but from certain privileges pertaining to membership. If this is the only difficulty existing to prevent the reunion of the Associations, and passing over certain very regrettable personalities that have taken place (which I am sure every gentleman will do), then, in the name of loyalty to the industry to which we are all bound, in the name of business and of common sense, let there be some *via media* agreed upon, so that we can, in unity and brotherhood, devote ourselves—not to the elevation of this or that section, not to the personal advancement of any clique or party, but, instead, to the furtherance, by contribution, exchange of experience, investigation and research, of all that pertains to the true success of the gas industry.

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Mr. W. W. Gillespie, Secretary of the San Jose (Cal.) Light and Power Company, indignantly denies that the gas supplied to the residents was largely mixed with air, a charge made by the consumers in the Empire street district. As the charge was not repeated in other sections of the city, it looks that Mr. Gillespie has much the best of the case as it stands, for the San Jose Company has but one series of distributing mains.

## How Electricity is Measured.

[A paper by Mr. Herbert Laws Webb, prepared for the *Engineering Magazine.*]

Amperes, ohms, and volts have almost become household words. In the newspapers they are to be seen every day, and since applied electricity has almost reached the prominence of a popular cult, the literary and semi-scientific journals handle the terms peculiar to the science with a seeming confidence in the ability of their readers to understand them that too often is misplaced. Very many intelligent persons have not yet had occasion to learn what amperes and ohms and volts mean to the electrical engineer, and how he makes use of them. They are the fundamental electrical units, and a clear understanding of what they represent and their relation to each other is an indispensable preliminary to any inquiry into the fascinating subject of electrical measurements. The relations between the volt, the ohm, and the ampere are fixed and immutable, and on these relations depend the remarkably accurate calculations and measurements that the workers in electrical science have evolved.

The volt is the unit of electrical pressure, or, as it is often called, electromotive force. The ordinary Daniell battery, containing zinc and copper elements in solutions of zinc and copper sulphate, gives an electrical pressure of one volt; in other words, the pressure available between the two poles of this type of galvanic cell was adopted as the unit of electrical pressure, and was named a volt, after Volta, the renowned Italian physicist.

The ohm is the unit of electrical resistance. All bodies offer a certain amount of resistance to the passage of an electric current. Those which offer a very high resistance are termed non-conductors or insulators, and those which offer a relatively low resistance are termed conductors. The insulators comprise such substances as glass, porcelain, vitreous and bituminous materials, india-rubber, gutta-percha, oils, and gums. The best conductors are the metals; water and solutions of salts and the human body are fair conductors. In order that the resistance of different conductors might be measured or compared, a standard or unit of resistance had to be determined. This was named the ohm, in honor of the German scientist who gave to the world the laws of the electric circuit. A column of mercury a fraction over 106 centimeters long with a cross-sectional area of one square millimeter, has a resistance of one ohm. A copper wire of the same sectional area, and having a resistance of one ohm, would be about 60 times as long as the mercury column, as copper is a much better conductor than mercury. The copper wire generally used for telephone and telegraph lines has a resistance of a little over 4 ohms to the mile. An iron wire of the same size would have about 6 times the resistance, as iron is a much poorer conductor of electricity than copper. Iron wire is used as an electric conductor only for telegraph lines; its cheapness and strength recommend it for this work, but even for telegraph lines copper is replacing iron to a great extent. In the distribution of electricity on a large scale copper is used exclusively, as it is for the coils of almost all electrical machines and instruments.

The ampere is the unit of current strength, and is so named from a French electrician. If a source of electricity having a pressure of one volt be connected to a circuit having a resistance of one ohm, the current that will flow in that circuit has a strength of one ampere. The ampere is derived from the volt and the ohm, and in order to produce amperes we must have volts acting upon ohms. A certain number of volts acting on a circuit containing a certain number of ohms *must* give a current of a certain number of amperes. If we have 10 volts acting on 1 ohm we get 10 amperes of current flowing in the circuit; and if we have 1 volt acting on one-tenth of an ohm, we get 10 amperes; while if we have 100 volts and 10 ohms, we get 10 amperes. Wherever an ampere is needed a volt must be available for every ohm of resistance to force it through the circuit. Wherever a path is open to the current it will flow through that path in exact proportion to its resistance, and the strength of the current will be proportional to the pressure that drives it. Take, for instance, an electric light circuit. The type of incandescent lamp in most general use requires the current of about half an ampere to heat the filament to incandescence. Consequently we see that the resistance of the lamp must be twice as many ohms as there are volts of pressure in the circuit. With 110 volts pressure, a lamp having a resistance of 220 ohms will allow half an ampere of current to pass through it. If the pressure is allowed to diminish, less than half an ampere of current will pass through the lamp and the filament will grow dull; if the pressure is increased, the flow of current will increase and the filament will get brighter. The flow of current, then, is dependent always on the pressure developed at the source of electricity and the resistance of the circuit to which that source is connected. If, for instance, in an electric light circuit where an unvarying pressure is maintained and acts on relatively high resistances of over 200 ohms, a path of very low resistance is suddenly provided by some accidental crossing of wires or rupture of the insulation, there will be an immediate rush of current through this low resistance; the lamps will be extinguished and the heating effect of the many amperes of current that will be concentrated at the point of very low resistance may melt the wires and set fire to any inflammable material in reach.

There is one other important electrical unit, which has been adopted of late years, since the distribution of electricity on a large scale for lighting and power has become so general, and that is the unit of electrical power. This is called the watt, and its value is the power developed by a current of one ampere at a pressure of one volt. In other words, one watt is an ampere multiplied by a volt. An incandescent lamp consuming half an ampere at a pressure of 110 volts takes 55 watts of electrical power. The watt is such a convenient expression that almost all expenditures of electrical power are now expressed in watts, or in kilowatts. A kilowatt is 1,000 watts, and is equivalent to about 1¼ mechanical horse power. A dynamo is said to be of so many kilowatts capacity; and the kilowatt-hour—that is, 1,000 watts for one hour—is the standard unit for current supply in England, and serves as a basis on which current is charged to the consumers.

The effects produced by the electric current are manifold, but a general classification may be made of the different methods of converting electrical power into some other form under three headings—electromagnetism, electrolysis, and heat. If a current be passed through a wire placed in proximity to or coiled around a magnetized needle, the needle will move, and every change in the continuity, direction, or strength of the current will be accompanied by a movement of the needle. Similarly, the movement of a steel magnet near a coil of wire will produce a current in the wire; and, again, if a wire be wound round a soft iron bar and a current be sent through the wire, the bar will become magnetized. When the current ceases the bar returns to its inert state, to return to power directly the current is turned on again. To this close relation between electricity and magnetism are due the galvanometer and many other forms of electrical measuring instruments, telegraph instruments of all kinds, the telephone and the dynamo and electric motor.

If a current of electricity be passed through a solution of any metallic salt between two metal plates suspended in the solution, the salt will be split up into its component elements and metal will be dissolved from one of the plates and deposited on the other. The process is termed electrolysis. It is governed by fixed laws, by which we know that a current of a certain strength will deposit exactly so much of any given metal per second, minute, or hour. Electrolysis or electro-deposition is used extensively in the arts for electroplating and electrotyping, and for refining of metals from their ores.

The conversion of electricity into heat takes place to a certain extent in all electric circuits. As we have seen, all conductors offer a certain amount of resistance to the passage of the current, and the work done in overcoming this resistance is manifested in the heating of the conductor. When the conductor is intended solely *as* a conductor, its resistance is made so low that the heat generated is slight enough to be easily disposed of by radiation. When, however, it is desired to turn the heat that the current is capable of developing to a good account, a high resistance is interposed. The incandescent lamp is an example of the conversion of electric power into heat; in overcoming the resistance of the carbon filament the current heats the filament to incandescence. In the arc lamp heat is developed by the resistance at the contact of the carbons, and the arc is sustained by the vapor of carbon produced between the two points. In many other applications of electricity heat is generated intentionally and for a useful purpose, but the two examples given in electric lighting are those with which the world has become most familiar.

In the various, or one might say multifarious, methods devised for the execution of electrical measurements of different kinds, use is made of the three effects of electricity described above—electro-magnetism, electrolysis, and heat. The primogenitor of all electro-magnetic measuring instruments is the galvanometer. In its simplest form the galvanometer consists of a coil of insulated wire in the center of which is pivoted a magnetized needle. To the spindle which carries the needle is attached above the coil a light metallic pointer, which moves over a graduated scale. The more delicate the balance of the needle, and the greater the number of turns in the wire in the coil, the more sensitive the galvanometer. The most sensitive type of galvanometer is that invented by Sir William Thomson, in which the needle is very small and

is attached to a tiny mirror about the size of a dime; the mirror and needle are suspended within the coil of wire by a single silk fiber, and a spot of light, reflected by the mirror from a lamp back to a paper scale placed about three feet from the instrument, serves as the pointer. The slightest movement of the needle is accompanied by a very appreciable deflection of the spot of light on the scale. This instrument was designed originally for transmitting signals through the Atlantic cable, and it was used on all long cables for many years, until the siphon recorder, which marks the signals on a continuous strip of paper, replaced it.

The galvanometer is used in making electrical measurements both by comparison and directly. For instance, in measuring the resistance of a wire a current is sent through the wire to be measured and through a set of standard resistance coils whose resistance is known and can be adjusted at will. The current has two paths open to it, one along the conductor, whose resistance is to be determined and the other through the coils whose resistance is known. The galvanometer is so connected that it will show by the deflection of its needle which path absorbs the most current. As we have seen already, the flow of current is proportional always to the resistance of the circuit, so that what must be done is to vary the resistance of the adjustable coils until the galvanometer needle remains stationary. That will indicate that the current flowing through the two paths is equal; therefore the resistance of those two paths must be equal, and as the resistance of the adjustable coils is known, the resistance of the conductor is found by reading off the number of ohms in circuit when the balance is obtained. This is one of the simplest of electrical measurements and can be performed with extraordinary accuracy, the resistance of conductors being determined down to one ten-thousandth of an ohm. The method of carrying it out can be compared to the simple act of weighing. The balance takes the place of the circuit having two branches, the pointer being the galvanometer at their junction; the material to be weighed is the unknown resistance and the weights the adjustable coils whose value is known, the attraction of gravity supplying the place of the current which permits the comparison to be made. The weights are adjusted until the pointer shows equality (just as the coils are adjusted until the galvanometer needle remains at zero), and the weight of the substance is then known by the value of the weights used in obtaining a balance.

In many cases electrical measurements are made by comparison with standard values, as in the example just given, the galvanometer being the indicator which serves as a means for establishing the comparison. In measuring electrical pressures, for instance, comparison is made with a standard cell whose pressure or electromotive force is known. Direct methods of measurement are also available, and of course for the commercial measurement of electricity it is obviously necessary to employ instruments which shall give direct indications. The relations between the volt, the ohm, and the ampere being fixed and immutable, it is plain that, any two of the three values being known, the other can be determined. If of any circuit in which a current is glowing we know the resistance (in ohms) and the pressure at the source of electricity (in volts), we can arrive at the current strength in amperes by dividing the volts by the ohms. Similarly, if we know the resistance and the current strength, we get the pressure by multiplying them together. There is an almost endless variety of laboratory methods for measuring electrical pressure, current strength, and resistance, all employing a galvanometer of some kind and a standard of comparison by which to establish the values of the unknown quantities.

Coming to the commercial measurement of electricity, it is obviously necessary, as has just been said, to provide instruments which shall indicate directly the values required to be known without manipulation or recourse to standards of comparison. In a central station those in charge must be able to know at any time what is the pressure on the circuits and how much current is being consumed by the lamps or motors. In most systems of distribution an unchanging pressure is maintained and the current varies according to the number of lamps or motors that are connected to the circuit. In other systems exactly the reverse takes place, the current being the constant element and the pressure the variable one. The power drawn from the station is in any case equal to the product of the two factors, and it varies continually as consumers turn their lamps and motors on and off. Consequently, in order to know what their machinery is doing, the attendants at the central station must have direct reading volt meters and ampere meters, which will indicate at any moment the pressure on the circuits and the amount of current flowing into them.

At the consumer's house or office a meter is required which will indicate the amount of electrical power supplied to his lamps or motors during any given period of time. This meter, unlike the central station measuring instruments, which can be arranged so as to be switched in and out of circuit at will, must be connected permanently in the circuit, so that it will record continuously the power that is supplied to the group of lamps under its surveillance. These electric meters, when designed for use on circuits where the pressure is kept constant, as for instance, in the low tension system of electric lighting, simply register the amount of current consumed by the lamps; the pressure being known, the amount of power consumed is readily arrived at. If on a 110 volt circuit a consumer has used 2,000 amperes of current in a month, the amount of power used is 220,000 watts, or 220 kilowatts.

In the design of direct reading or recording electrical measuring instruments the various effects of the electric current have been utilized in many different manners. The larger proportion of commercial measuring instruments, however, depend on electro magnetic mechanism for their action; that is, on the effect of the current on a coil placed within the influence of a permanent magnet, or vice versa. In other words, the family of electro magnetic voltmeters and ammeters are descendants of the galvanometer previously described. The construction of these instruments is comparatively complicated and involves a high degree of mechanical and electrical knowledge and skill and the most scrupulous use of the best material obtainable. Every instrument turned out is most carefully tested and calibrated by standards kept in the laboratory, and their readings, which are given by a pointer moving over a dial or curved scale, are generally accurate to within a fraction of 1 per cent. In recording instruments the current sets in motion a miniature electric motor, which communicates its movements through a train of wheels to a set of pointers arranged over dials, similar to those of a gas meter, corresponding to units, tens, hundreds, thousands, and tens of thousands. The speed of the motor varies with the power passing through it, and consequently the pointers on the dials move slowly or fast according as the power consumed is small or great. The figures on the dials represent watts, and if the charge is so much per kilowatt the consumer can ascertain at any time the amount of his indebtedness to the company.

A very ingenious form of meter is that used by the Edison Companies. It is an electrolytic meter and consists of two plates of zinc suspended in a jar containing zinc solution. The current, passing from one plate to the other, dissolves zinc from the first plate and deposits it on the second. A current of any given strength will deposit exactly so much zinc in a given time. The weight of the plates being accurately determined before the meter is put in use, the difference in their weight at the end of any period of time will indicate how much current has passed through the meter. The meter is so connected that exactly one-thousandth part of the current used by the consumer passes through it. The meters are removed periodically and the plate which has suffered loss of metal is carefully washed and dried and then weighed in a chemical balance. The difference between the original weight and the weight found shows the amount of metal deposited on the other plate. The reason for weighing the plate which has been dissolved rather than that on which metal is deposited is that greater accuracy is secured, as a certain amount of zinc always remains in the solution. The difference of weight in grains shows the number of amperes used by the consumer.

## One Horse Power to Four Feet of Heating Surface.

*Iron Age* reports that at the office of the Hogan Engineering Company, Stewart Building, New York, a test was recently made of a small model of the Hogan water-tube boiler, having a water capacity to the water line of 6½ pounds of water, equal to 6½ pints, or 180 cubic inches. The principal dimensions of the model are as follows:

| | | | |
|---|---|---|---|
| Surfaces— | | | |
| Tubes over fire | 288 sq. in. | = 2.000 | sq. ft. |
| Sides of fire box | 31 " | = 0.215 | " |
| Under side of shell | 30 " | = 0.208 | " |
| Heating surface exposed to gases. | 349 sq. in. | = 2.423 | sq. ft. |
| Tubes in model not " " | 148 " | = 1.027 | " |
| Total surfaces | 497 sq. in. | = 3.450 | sq. ft. |

The steam openings consisted of one copper pipe 12 inches long by ¾ inch internal diameter, and one ¼ inch diameter hole to a whistle. The fuel was city gas, supplied through 10 bunsen burners, with needle holes, screwed into one gas receptacle supplied by ¾-inch common gas pipe. Each of these burners when placed on a pipe by itself is capable of consuming from 3 to 4 feet of gas. When placed on one chamber these burners will not consume quite as much gas per burner. The temperature of the room was 76°, and of the water 74°.

In six minutes from the time of lighting the burners steam was produced, and in 25 minutes after lighting the gas the test was begun. The water line was kept at a constant height.

The feed water was arranged to pass in continuously from a pail through a siphon hose. The pail with water was weighed before the test begun, and when the test was finished it was found that 9.25 pounds of water had been evaporated from 74° to steam at 212° in one hour. The pressure indicated was equal to a water column 1 inch in height.

The total units of heat taken up by the surfaces exposed to the heat of the gases are as follows:

212° — 74° = 138° from temperature of feed water to boiling point.

966° latent of steam at 212° + 138° = 1,104° or units of heat for each pound of water.

1,104 × 9.25 pounds of water = 10,212 total units of heat.

$\frac{10.212}{12} = 10.57$ pounds of water evaporated from and at 212°.

According to experiments by Peclet, the conducting power of iron and glass is "the quantity of heat in units transmitted per square foot per hour by a plate 1 inch thick, the two surfaces differing in temperature 1°," under which conditions iron transmits 233 units of heat for each degree of difference between the two surfaces, while glass transmits 6.6 units of heat for each degree of difference. The same authority shows that the heat-absorbing power of iron and glass is about the same per square foot of surface per hour for each degree of difference in temperature—that iron absorbs 0.57 units of heat while glass absorbs 0.59 units of heat under the same conditions. From which it is apparent that iron or steel tubes will conduct or transmit the heat from fire to water much more rapidly than glass tubes. When the boiler is fully inclosed, as in practice, and with metal tubes in place of glass tubes, there can be little doubt that each square foot of surface will double in its relative effectiveness, as shown by this test of the model boiler.

Taking the heating surface, 2.42 square feet, it is apparent that $\left(\frac{10.57}{2.42}\right)$ each square foot of surface evaporates, from and at 212°, 4.36 pounds of water. The evaporation from and at 212° of 34.5 pounds of water is the equivalent of a horse power; therefore the model boiler with glass tubes is $\left(\frac{2.42}{7.9}\right)$ $\frac{3}{10}$ horse power, or $\left(\frac{34.5}{4.36}\right)$ 7.9 square feet of glass surface similar to that in the model boiler is capable of producing a horse power. And, as already stated, the saving from loss of heat alone, by inclosing the return flues as they will be in practice, will raise the efficiency of the surface to $\left(\frac{7.9}{2}\right)$ 3.95 square feet per horse power; that is, each square foot of heating surface will evaporate per hour, from and at 212°, 8.72 pounds of water. Without making any allowance for the glass surface, as demonstrated in the test of the miniature boiler, the effectiveness of the surface is marvelous when compared with the effectiveness proved by Isherwood and Trowbridge.

| * Kind of Boiler. | Square Feet of Heating Surface for 1 H.P. | Authority. |
|---|---|---|
| Water tube | 10 to 12 | Isherwood. |
| Tubular | 14 to 18 | " |
| Flue | 8 to 12 | Prof. Trowbridge. |
| Plain cylinder | 6 to 10 | " " |
| Locomotive | 12 to 16 | " " |
| Vertical tubular | 15 to 20 | " " |

The test of this model gave the following:

| | | |
|---|---|---|
| Hogan water tube | 4 to 8 | Test of model. |

The fire tubes in the model are inclosed in a shell of thin sheet iron lined with asbestos. The water tubes leading from the steam drum at the top of the combustion chamber to the bottom are on the outside of this shell, and the air in the room circulated freely around them, thereby lessening the effectiveness of the model. If a model of this size and constructed of material so poorly adapted to the purpose gives exceptionally good results, far better results should be obtained from a full-size working boiler. We may state that glass was used in the model in order that the circulation might be seen plainly.

With manhole and steam orifices wide open, and with the hottest possible fire, the water in this boiler will not overflow. It might be said the construction of this boiler permits the water to fall away from the steam, instead of the steam leaving the water. It can be truthfully stated that the design and construction are entirely new, and have never been attempted in any shape or form. Its simplicity is one of its attractive features, as well as its lightness and strength. Pressures of 300 to 400 pounds can be carried. The getting up of steam depends solely on the rapidity with which the fires can be lighted, as the sudden introduction of heat cannot injure or strain any part. Cold feed water will not injure the surfaces or joints, as three half pints of water can be thrown into the glass model without producing any injurious effect, merely lessening the steaming power for a few seconds.

The principles used are adaptable to forms of boilers suitable for marine and locomotive purposes, as well as stationary. The outside form of the boiler may be rectangular—that is, oblong or square—or circular. The height of the boiler can be varied to suit any conditions, but the greater the vertical height the greater the economy in working.

Although the model is open to inspection, it is not possible at the present time to publish a detailed description of the design, because the foreign patents covering the latest modifications have not yet been filed.

* Taken from "Steam," by Babcock & Wilcox, New York and Glasgow.

## Carbonizing Methods, Past and Present.

[A paper read by Mr. W. J. Carpenter, of Yarmouth, before the Eastern Counties Gas Managers' Association.

In selecting this subject for the remarks I am about to make, it occurred to my mind that we, in the eastern counties, might do well to discuss and to carefully consider the whole question, with a view to more economical working, and, moreover, to possess ourselves of the condition of things happening in and around these important matters. The question of carbonizing, comprising as it does the primary points in gas manufacture, demands that we should do our utmost to take advantage of any improvement which may present itself, and which has for its object the cheapening of production, and the protection of the men employed in the arduous task of stoking. On reference to the earlier days of gas manufacture, we find repeated instances of men's mind being directed to the development and improvement of carbonizing schemes, not only so far as the placing of the coal into the retort, and the subsequent removal of the coke, but also with reference to the details in connection with retort setting, the arrangement of the benches, and last, but not least, the section of the retort and the means of heating to be employed. The result of these early efforts, supplemented from time to time by most important improvements, by many clever engineers who have closely followed the subject, has been of a highly gratifying order; inasmuch, that we have now plant and arrangements within our grasp, by which we are enabled to deal with varied kinds of coal and cannel so satisfactory as to extract every cubic foot of illuminating gas available; thereby economizing greatly as regards raw material.

The subject of high and low heats I take as fairly well threshed out; and the former, consistently employed, are, no doubt, most popular among engineers. In my experience, systems which lend themselves to irregular heating cause much anxiety, not to say considerable trouble, and consequent bad working and monetary loss. It will probably be said that with high heats the gain aimed at is counterbalanced by the amount of difficulty found in keeping the ascension and dip pipes free from pitch deposits, and I am conscious that care has to be exercised in dealing with some kinds of material; but, given proper attention, we are able to make a more permanent gas by employing regularly high heats, and making the charge of coal as heavy as possible in preference to encouraging any inclination on the part of the men to charge lightly. The form of setting still varies very much in accordance with usage and local requirements, but in medium sized provincial works the setting of 6 ⏀ retorts is more generally adopted than any other plan; and in most instances where the charging and drawing is effected without stage flooring, it is in many ways a convenient and economical setting.

Engineers differ as to the size of the retorts employed, and produce results against results in favor of one or other idea. My own experience compels me to say that for works employing the old system of hand labor (viz., scoop charging and hand drawing), care should be exercised in order that the retorts be not too large; a medium size is preferable, as it facilitates the work, the men not being exposed so much to the heat; and the make per mouthpiece, taken on the average, will compare with the large sections under these conditions.

The method of heating gas retorts, having regard to regularity, effectiveness, and thoroughly economical working, is still a point upon which one might be excused to say a few words. We are told that regenerator furnaces, entailing as they certainly do such extraordinary and costly alterations to existing works, prevent waste to such an extent that they readily repay their cost. Various companies and corporations were prevailed upon to apply the various systems in building new works, and trials have been made, and, I believe, are continued in this important direction.

The generator furnace has, apparently, outstripped the former, and when last I heard of results, and saw the working, viz., the working at

the East Greenwich gas works, my mind was impressed with the sound improvement made. I have tried generator furnaces with great success, although handicapped by being unable to obtain all the advantages, by reason of our experiments being carried out with existing benches. Nevertheless, I have settings now at work which have been in operation over 1,000 days, a record not to be obtained by the ordinary or direct fire. I, however, manufacture most of our gas by means of the direct fire, and the results are exceedingly good by these means. Several other works I know, where splendid results are obtained, use direct fires, and get paid for a quantity of gas per ton which point to a good working, beyond doubt. I find, however, that the wear and tear of furnaces and retorts is great compared with generator furnaces. Now, having gone so far as this, which brings us to the fact that the retorts and settings are capable of receiving and dealing with the raw material in a complete manner, I propose to move on to the methods of manipulation which have been such an all-consuming study to so many of our mechanical engineers.

From the earliest plans and ideas we have as history down to the year I purpose commencing my remarks from, 1878, there was, without exception, a great endeavor to produce some means whereby the heavy retort house work should be effected by mechanical means; and the various inventors appear to have agreed that such mechanical means should be, if possible, automatic in their action. In 1878 a continuous automatic gas making apparatus was patented. A paper upon this was read before the British Association of Gas Managers in that year. In order to illustrate the idea I have obtained the model, and will endeavor to briefly describe the inventor's ideas and difficulties, and trust it may be interesting to those present.

The model illustrates the plant as erected and worked under the inventor's supervision, the retorts being inclined, and the carbonizing chamber being common to both sides of the settings. The idea generally was to gradually and continuously carbonize the coal by receiving the same on screws of large pitch, and thrusting it down the inclined retort until the coke would fall into the carbonizing chamber; such carbonizing chamber being considered necessary in order to prevent any coal passing away in the coke without being fully treated. This was carefully carried out, and gas was produced in large volumes per mouthpiece, one of the experiments lasting one month without stopping the apparatus. The coke was splendid, and economical views satisfied on all sides. Constructional cost was considered to be an overwhelming difficulty in supporting this scheme, and although the apparatus handled the coal automatically, and the coke was precipitated into a barrow below, no move was made towards trying the idea on a large scale.

The latter day experience of huge strikes and labor organizations has had the effect of widening our views upon endeavors in this direction, and I may be pardoned for giving an opinion that this apparatus is nearer perfection than any other form of inclined retorts introduced. At the same time machinery was being produced, and the production has gone on, I am glad and pleased to acknowledge, with such admirable courage and skill that it is now possible to completely and successfully manipulate the most difficult and varied kinds of coal and cannel, and to effect a real economy in the working.

The model illustrates the manual machine invented by Mr. John West, who has been perhaps the most assiduous and successful engineer in grappling with the many difficulties and prejudices surrounding the introduction of labor-saving appliances. The machines are in ample evidence in works in the United Kingdom and abroad. Mr. West's idea, throughout his career, has constantly been that of an even charge of coal, properly and surely distributed in the retort; it has been to him a paramount consideration, and the machine, as in model, can be thoroughly relied upon to carry out all required of it when in practical operation in either large, medium, or small works. The mode of operation in this system is to crush and elevate the coal, storing a sufficient supply in overhead hoppers. The traveling machine and hopper takes its required quantity from time to time from the store hopper, and is then propelled to its position in front of the retorts to be charged. The small charger, having been filled by a revolving arrangement of feeder, is pushed into the retort; and by turning the handle the coal is deposited and leveled, presenting, when seen in the form of coke at the end of the charge, a perfectly even layer. Thus each superficial foot of the retort floor receives its regular work each charge, and methodical working is guaranteed. The discharging is accomplished by means of a traveling hand rake. The cost of production by these machines, after taking into consideration wear and tear and contingent charges, may be fairly taken as showing a reduction over ordinary work of a shilling per ton of coal carbonized. The retort house arrangements need, however, to be made complete, in order that the whole of the advantages may be derived.

The machines produced by Mr. John West also include those actuated by compressed air and wire rope systems; and the ingenuity displayed in their construction points to the masterly appreciation and knowledge of minute detail so apparent in all his work, and I am assured the gas profession has much to thank this gentleman for, his efforts being untiring.

With the advent of labor difficulties, the subject of automatic appliances received renewed consideration, and systems of inclined retorts were experimented upon with admirable vigor. The most recent development of the inclined retort system has met with more or less success, if we may take the public utterances of engineers who have experimented with it to be a criterion. In this system the coal has to be elevated, placed into charging hoppers and shoots, and conveyed into the retorts ready for carbonization. When carbonized the coke resulting is allowed to fall out by opening the lower doors, and the retort is again closed ready for a fresh charge.

Machinery of a more or less elaborate character has been brought into use in order to promote an even layer of coal in the retort (without an even layer proper carbonizing is impossible). I am not prepared to speak, from experience, as to the success or otherwise of this system; but these are difficulties which appeal to my mind as being insurmountable under the conditions; the coal is naturally likely to deposit in a thicker layer at the bottom end of the retort than at the top, and condensation going on near this end, increasing the difficulty, must be likely to render the coke spongy; and a waste of tar occurs, besides being likely to make the work irregular; and, moreover, I am of opinion that if we must have machinery actuated as in the case of some of the inclined systems, not automatically, then we had better not change our mode of setting.

In my experience, following experiments, machine charging and drawing can be properly effected in horizontal retorts, and only improperly effected in inclined ones. It is regular and systematic working which tells in the end, which is necessary above everything in a retort house, and this must be brought home to most men when witnessing the work of the "West" machine in houses where arrangements have been properly made to receive the same. As regards the general question, I am satisfied to make that of discharging the retort a secondary consideration. The charging must be right to economize, and hence in my idea the machines and horizontal retorts will bear comparison with the best work it has been my fortune to witness. I hope the few remarks I have made will lead to a discussion which may tend to cheapen production in our works. Our aim should be strict economy, and provided adequate means are available, we must be at fault if we do not embrace them.

## The Manufacture of Vitrified Sewer Pipe.

Mr. William C. Klingelhoefler, in an article on this subject prepared for the *Technograph*, remarks that the process herein described is that used by the well-known firm of Evens & Howard, St. Louis, Mo. Their mine and factories are located at Howard Station, on the Missouri Pacific and St. Louis and San Francisco railways. The sizes manufactured by them vary from 3 to 24 inches in diameter, and the capacity of their works is 100 tons of pipe per day, which is equivalent to a mile of 10-inch pipe, one-half mile of 15-inch pipe, or one-fifth mile of 24-inch pipe.

The fireclay is mined near the works from a vein 8 to 10 feet thick and 60 feet below the surface. It is of a grayish color, its specific gravity is 1.75, and its hardness is one-half to three-quarters, taking talc as one and diamond as ten. It is mined in the same manner as coal. That for pipe is molded at once, while that intended for brick, tile, and retorts is weathered by dumping in a pile and allowing rain, frosts, etc., to pulverize it. The surface soil is the ordinary dark soil on the surface, and is taken as it is needed. The loamy clay is used to reduce the cost of material and to reduce the temperature required for vitrification.

The clay is prepared for molding by being passed through the "dry mill," and then through the "wet mill." The dry mill consists of a horizontal rotary disk or pan, in which roll two heavy wheels. The disk is of cast iron, and is 9 feet in diameter; that portion upon which the wheels grind is solid, while the portion from the wheels outward is perforated, so as to allow the finely ground material to drop through. The disk is fixed to a vertical shaft, carrying at its upper end a miter wheel, which gears with a similar wheel on the main shaft. The wheels are of cast iron, with hard cast iron tires which can be replaced when

worn out, and are 4 feet in diameter and weigh 6,000 pounds each. They are mounted on a horizontal axle, which is free to slide between vertical guides, are placed 4 feet apart, and rotate by contact with the horizontal disk.

Into this dry mill the fireclay and grog are thrown and ground. The material on leaving the wheels is thrown outward by the rotation of the disk, and fine material falls through the holes in the disk and the coarser particles are again brought under the wheels by two scrapers at opposite parts of the pan. The finely ground material is carried over a set of screens; that which passes the screens goes to the bin, while the coarser particles again return to the dry mill.

The wet mill differs from the dry mill in that in the former the disk is not perforated and the wheels weigh 3,500 pounds each, instead of 6,000 pounds. Otherwise the two are alike.

From the bin the dust is allowed to run into the wet mill, where it is mixed with water and reground until it forms a paste. Then the surface soil is added, and the whole wetted and ground until it forms a stiff mud, when it is delivered by means of a scoop into the elevator which conveys it to the press.

The press consists of a steam cylinder and piston, a mud cylinder and piston, the bell, the die, and the bell or socket former. The steam piston is 40 inches in diameter, and is connected to the 20-inch mud piston by means of three rods. When the steam pressure is 90 pounds per square inch the pressure exerted by the mud piston is 360 pounds per square inch.

The mud cylinder is vertically underneath the steam cylinder, and has attached to its lower end the die. This die is of cast iron. Its lower end shapes the outside of the bell or socket of the pipe. Above the socket former the die is a right cylinder for two or three inches. This part shapes the body, or straight portion of the pipe. Above this the die is divergent or convergent, as the pipe is smaller or larger than the mud cylinder. The bell also is of cast iron, two or three inches of its lower end being a cylinder of a diameter equal to the inside diameter of pipe. Above this part the bell is made tapering to connect it with a heavy rod which passes through the mud piston and is fastened to the steam cylinder. The bell hangs in the center of the mud cylinder and die, with its bottom flush with the bottom of the cylindrical part of the die. Inside the die, and even with the bottom of the bell, is a knife which travels in a circle and cuts the pipe to the desired length.

The socket former is a cast iron disk with holes perforated in its surface, and is equal in diameter to the inside diameter of pipe socket. It is fastened to the top of a vertical rod, and is held in place by means of hooks on the lower part of the die.

When the mud and steam pistons are at their upper limit, the socket former is put in place and the mud cylinder filled with mud, steam is admitted and the mud is forced by the mud piston and conical bell into the die. When the mud oozes through the holes of the socket former the socket of the pipe is finished. Then the socket former is released and it descends, and the straight part or body of the pipe is formed as the mud is forced out of the mud cylinder between the die and the bell. When of proper length the pipe is cut off by the knife.

All sizes of pipe can be made in the same press by changing the bell, the die and the socket former. Curved pipes are moulded by moving the bell slightly to one side, allowing the clay to be forced out faster on one side than on the other.

Junctions are deftly made by hand. A hole is cut in the side of the larger pipe by a knife, the smaller pipe is trimmed or mitered to fit it at the proper angle, and the joint is plastered up with clay. This is done while the pipes are green, and no pattern is used or measurements taken.

The pipe is next conveyed to a room heated by steam pipes, where it is set on spigot end to dry, remaining from three to fifteen days, according to the weather.

When the pipes are perfectly dry they are stacked up in the kiln, spigot end downward, the small ones inside the larger ones. The bottom layer of pipe is set on extra rings provided for the purpose; otherwise they would be damaged by cracking. The kiln is essentially the same as the down draft kiln used in burning farm tile, but the heat used is considerably greater. After the kiln is filled with pipe all doors are closed and the contents gradually heated, coal being used for fuel.

The time of burning depends upon the size of the kiln, kind of clay, etc., but usually is about five days. The temperature of the kiln and the progress of the burning are determined by means of small clay test pieces placed within reach in the kiln. When the pipes have nearly reached the point of vitrification, the heat is raised to between 2,400° and 2,500° F., and a shovelful of common salt is thrown in on the fire. This is repeated three or four times in an hour.

The salt is volatilized in the presence of moisture, hydrochloric acid is disengaged, and the sodium unites with silicon of the clay, forming with the silicate of alumina a fusile double alkaline silicate or glaze on the pipe. This glaze is a union penetrating the surface and forming a part of the pipe instead of being a mere skin. For perfect glazing it is necessary that the salt be used when the temperature of the kiln corresponds to the temperature both of the fusion of the pipe and of the fusile condition of the glaze. Such glazing renders the pipe non-absorbent and impervious, and gives it a smooth, slippery surface. A barrel or less of salt is used for a 20-foot kiln 15 feet high. Sometimes a single dose of salt is used much less than the preceding. Sweepings from packing houses are utilized. This finished, the fires are banked, and the annealing is effected by allowing the kiln to cool down slowly, requiring from four to five days.

In drying and burning, the various sizes of pipe shrink about 10 per cent. in length and 10 per cent. in diameter, so that each pipe is molded $\frac{1}{8}$-inch larger per inch of diameter than its desired diameter.

In burning, under-vitrification is better than over. When overburned, blisters show on the surface, the material expanding and appearing in layers and the pipe becoming rotten. If underburned, the pipe has the appearance of clay.

## ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

In our issue of September 26th we gave some facts concerning the business of the Worcester (Mass.) Gas Light Company for the year, and while our report was in the main correct, an error, although of comparatively little moment of itself, because of its palpability, occurred in that portion of the report where the present work of betterment going on is referred to. Just before the output figures for the past five years are given it was said: "In speaking of the 10-inch mains the Company is now laying, the report says they are made imperative by the increase in the Company's business." The fact is that the mains now in process of placing are pretty much all of the 20-inch order, and are intended to be used as feeders from the new million foot holder up and through almost the entire length of the principal business street of the city. Of course, mains of this diameter are much more like what the Company needs for its principal feeders than the 10-inch type first stated, and also go to show that Worcester's gas folks do not hold to the view that 10-inch pipes are of exceeding size or dimension.

Mr. E. G. Cowdery, Engineer and Superintendent of the Milwaukee (Wis.) Gas Light Company, writing to us under date of September 29th, forwards the following:

To the Editor American Gas Light Journal: Some time ago I wrote you asking for information as to how much coal tar was produced in the United States annually, and how much was imported; also, some information regarding sulphate of ammonia and benzole. Your reply was duly received. After investigating the matter so far as I have been able, I am obliged to accept the estimate of Mr. Charles H. Welch, Secretary of the Athens (Ohio) Gas Light Company, in relation to the coal tar that was produced in the United States, as 700,000 barrels. I learned from the Treasury Department, at Washington, that there was imported into the United States, for the year ending June 30th, 1892, a quantity of coal tar and coal tar pitch equal to 117,056 barrels. This appears to me a small amount, and it would not seem that it was large enough to depreciate the value of that material in the United States, from $5 to about $2 or $2.50. I also learn from the Treasury Department that during the same year there were imported 9,906,590 lbs. of sulphate of ammonia and something like 9,000 barrels of benzole, dead oil and other products from the distillation of coal tar. I thought possibly it might be interesting to you to have this information, as I had taken pains to collect it; if published it might be of use to others.

We are indebted to Mr. Cowdery for the figures, which are of not a little interest. They also maintain Mr. Cowdery's deduction that an import of tar and pitch amounting to, say, 16½ per cent. of the total home production, does not completely account for a decrease of 50 per cent. in the all-round price of the commodity.

The handsome new water gas plant, which is of the Wilkinson type, of the Nassau Gas Light Company, of Brooklyn, N. Y., is about completed—the result of 16 months of close attention and much bustling. The plant, which is located on a site adjoining the Company's coal gas plant on Kent avenue, has among its main features the following apparatus: 4 Wilkinson generators, each rated to supply 700,000 cubic feet per day; 5 benches of fixing retorts—sixes, and through retorts; two

250-horse power Hazelton boilers; 2 Root exhausters; 2 Root blowers; 4 purifying boxes, each 25 feet by 30 feet—these boxes are fitted with an ingenious hydraulic lift, devised by Mr. Mayer, the well-known engineer of the Bartlett-Hayward Company; 2 multitubular condensers, 10 feet by 20 feet; a 12 foot commercial gas meter and an 11 foot hydrogen gas meter; a hydrogen holder on the double lift order, capable of storing 100,000 cubic feet; and 2 storage oil tanks, each 30 feet in diameter and 30 feet in height, each capable of retaining 180,000 gallons of oil. The inclosing structures are handsome buildings, and rest on a thickly studded base foundation of piling. The plans complete were the joint production of Col. Benson, Engineer to the Nassau Company, and of Mr. Mayer, and the latter was in charge of the placing and erection of the machinery, and the net result is greatly to the satisfaction of the Company, to the Engineers and to Messrs. Bartlett, Hayward & Co., the contractors. The plant is fully up to a sendout of 2½ millions cubic feet per diem.

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WRITING of the successful completion of this task puts us in mind that Col. Benson has completely recovered from the dangerous attack that prostrated him this summer. In fact, he looks "as hard as nails," and will doubtless be on hand in Boston shortly to answer to the roll-call at the coming meeting of the American Association.

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A CORRESPONDENT informs us that Eugene Ahearn, an employee of the Portland Gas Light Company, of Portland, Oregon, who was prostrated on December 6, 1891, by an electric shock, has instituted a suit for damages in the sum of $12,850 against the Oregon Telephone and Telegraph Company. He bases his claim on the statement that, on the evening mentioned, while returning home from work, he slipped and fell, at the corner of Kearney and 21st streets. As he fell he threw his right hand out for support, and seized what proved to be a telephone wire which had broken and fallen to the sidewalk, and made in its fall connection with a live electric wire. Ahearn, who could not loosen his hold on the wire, in his struggles laid hold of the wire with his free hand. Although assistance came almost immediately, his body was so scarred with burns that for several months he was incapable of working. He was confined to his bed for some weeks.

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MR. O. HIGMAN, an electrical expert, working in connection with the Department of Inland Revenue, of Canada, has prepared an ordinance or law for the inspection and regulation of the supply of electric lighting currents. The Hon. Mr. Costigan will introduce the bill at the next session of the General Legislature.

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MR. C. M. KELLER, of Columbus, Ind., writing to the JOURNAL under date of Sept. 29, says, among other things: "* * * I will not be able to visit Boston this fall, as my hands are full here at present. The merchants have organized an electric light company, and expect to start in on Saturday to 'wipe us out.' I must admit they are doing very well for a new company, but we expect in the near future to let them know that we are in town. The coke crusher business is good, having sold 12 machines since the 1st of August."

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THE residents of Barton Heights, a suburb of Richmond, Va., have petitioned the Gas Trustees for a supply of gas and water.

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THE proprietors of the Norwich City (Conn.) Gas Company have ordered a reduction in the gas rate, from $2.25 to $2 per 1,000 cubic feet. The new schedule went into effect on October 1st.

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"OBSERVER" forwards the following respecting certain "tangles" between the authorities and the proprietors of the Amherst (Mass.) Gas Company: "Four years ago the Amherst Gas Company connected (without having consulted the Selectmen, the latter say) its drain with the main sewer emptying into Fearing's brook. Subsequently, Mr. John C. White, on whose land the sewer emptied, complained to the authorities that the drainage contained tarry matters, evidently from the gas works; and since then there has been more or less contention between the town and the Company. Eventually the town instructed the Selectmen to cut off the Gas Company from the sewer, as the State Board of Health notified them that the gas works drainage must not be allowed passage through the sewer, but the Company got out an injunction against the town. Thus the matter hung, and a great deal of bickering was the result. Now, however, the case is likely to be satisfactorily adjusted, as the Company, by means of settling tanks, separates the tar from its general drainage, passing the water on to Fearing brook outlet practically untainted."

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MESSRS. GEORGE W. PIERCE & CO., plumbers and gasfitters, of Portland, Maine, have failed.

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MR. EUGENE VANDERPOOL, President-Engineer of the Newark (N. J.) Gas Light Company, has returned from his European outing, which evidently benefitted him greatly.

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MR. JARLEY—"Smutter; did you ever try a gas meter in your house?" Smutter—"Yes; and generally found it guilty, too!" Of course, that is from Chicago.

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SOME time ago we had occasion to refer to the peculiar tactics adopted by the electric lighting speculators of Westboro, Mass., to prevent Mr. H. S. Jackson and associates from obtaining a franchise to operate a gas works in that city, the electricians urging that under their charter they had the right to carry on such work, although they admitted tacitly they had never thought of going on with the gas enterprise until Jackson & Co. came on the scene. In complimenting us on the stand taken by the JOURNAL respecting that controversy, Mr. Jackson forwarded us some figures (see issue of Sept. 12, p. 362) going to show why New England gas securities were much to be preferred over electric lighting securities of the same district as a money-getting investment. He subsequently compiled a statement at greater length than the original one, and circulated the same in the form of a circular. Believing that our readers will find this matter to be of interest, we herewith reproduce the same—it bears the title, "Investments in New England Gas Companies:"

"*Fair* and *open* competition in business is not only permissible but desirable. Misrepresentation, under the guise of business ability and shrewdness, is to be deprecated. Faith in one's business inspires confidence that cannot be destroyed by him whose methods fear honorable competition. The assertion having been made by promoters of electric lighting that the use of gas was fast becoming obsolete since the introduction of electricity, and that the ultimate end of all gas works would be that of the defunct mail coach, it may be well to silence these electric light shouters by giving a few facts regarding the growth of the gas industry during the past decade, or since electricity has been utilized for furnishing light. The figures herein given are copied from the annual reports to the Board of Gas and Electric Light Commissioners, made by the Companies of Massachusetts, in compliance with law, and under oath of the proper officers. There are in Massachusetts 84 electric lighting companies—57 producing electric lights only, and 27 supplying both gas and electricity; of the former, 32, of the latter, 7, fail to pay dividends. There are, also, in this State, in active operation, 70 gas plants, 51 of which paid dividends last year. Nineteen Companies paid no dividends, and 9 of these operated electric lights as well as gas. This shows that of the 84 electric light companies, 45 paid a dividend, or 54 per cent., and of the 70 Gas Companies, 51 paid a dividend, or 73 per cent. The total sales of gas in Massachusetts for the years ending June 1st, were—1886, 2,389 millions of feet; 1887, 2,522 millions; 1888, 2,737 millions; 1889, 2,933 millions; 1890, 3,291 millions; 1891, 3,902 millions. A yearly output of gas in Massachusetts, in 1891, of more than 1,500 million feet over that sold in 1886, five years previous; an average gain of 300 millions every year—a fact which will fail to convince the public that gas interests are in danger of ruin by the introduction of electric lighting. Another fact may well be noted. There has never been so much gas sold in the United States as since the introduction of electricity. The gain has been vastly beyond what the natural increase of population would account for. The reason is twofold. First, the introduction of the brilliant arc light educated the masses to demand more and better illumination for both highways and dwellings. This demand set gas engineers and scientists at work with redoubled energy to discover methods of gas manufacture that would compete with electricity in producing a more brilliant light for less money than any electric system would afford. They have accomplished the end sought in the discovery of new methods of making gas, by which its brilliancy is greater than that of any incandescent electric light, and its cost is much less than the latter product. Old methods * * * have given way to * * * systems that are cleaner, less dangerous and more economical, and permit of the product being used for heating, cooking and power, as well as for light. The second reason is that 20 years ago not 20 gas stoves were used in this State; now there are over 9,000 in constant use, supplied by but 27 of our 70 Companies. Every gas corporation is introducing gas stoves, gas engines and gas for heating engines, running boilers, etc., a move which will undoubtedly double the stove and fuel service by another year. As gas for these purposes is generally used throughout the day, it more than doubles the use of mains and pipes which, heretofore serving gas for light only, were idle more than half the time, thereby largely increasing expenses of operating plants. The

greater the output of gas per mile of main, under good management, the more profit of the Company supplying it. Conservative gas engineers estimate the amount of gas used for fuel, when once generally introduced, as being six times greater than that for lighting purposes only. This shows that the future of gas is absolutely assured beyond any question, and that its output must continue to increase year after year. The Cambridge Gas Company sold, in 1880, 57 million feet of gas, and in 1891, 126 millions; the Worcester Gas Company sold, in 1880, 40 millions feet of gas, and in 1891, 124 millions. There is no good reason why communities of 4,000 people and upwards, compactly situated, should not enjoy the privilege of gas as well as of water and sewage. An excellent gas for light, of 22-candle power value, can, by modern appliances, be made so as to be sold in such localities for $1.25 to $1.50 per 1,000 feet; and, for cooking, heating and power, the gas, being rich in heat units, is cheaper fuel than coal at $4.50 per ton. These inland towns being without gas, use coal costing from $6 to $7 per ton—sawed and split wood being in most instances even higher. A rich carbureted gas, when used for heat only, is reduced at the stove burner to its original condition of a *plain* gas. A foot of 22-candle carbureted gas * * * contains nearly 1,000 units of heat, while a foot of plain, or uncarbureted, has less than 300 available heat units, making 1 foot of the former, for heating purposes, more than equal to 3 feet of the latter. No incandescent system of electric lighting yet discovered can compete with such gas at the prices named. In the early days of electric lights, many gas managers became alarmed, and completely 'lost their heads' through fear that their business would be ruined by such competition, and hastened to buy up existing electric plants, or add new ones to their gas works. At the present day, however, there are few of these Companies that do not regret their hasty action, and were it possible to obtain from them a true statement of their present feeling regarding the electric portion of their business, it is highly probable that their remarks would be other than complimentary of their new acquisitions. The gas business of to-day, with the improvements made in apparatus, the excellent product sent out, the low prices that prevail, hence the greatly increased output, together with the immense business in prospect for other uses than light, and the fact that under good management few losses can occur, should make this industry sought after by capitalists and investors generally. In this State the business is practically a monopoly, for the reason that the law will permit but one Gas Company (rendering good service) to operate in a community; the sales are for cash, and the laws are stringent against consumers who fail in their payments, when due for gas used. Furthermore, the money of investors is placed *at home, nearby*, where it can be constantly looked after and good returns secured for its use. This is not so with many investments (so-called securities) which have for years been indulged in by our New England people to their sorrow. Patronize home industries, which are safe and always within sight."

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Mr. James Gow, President of the Board of Public Works, of Muskegon, Mich., advertises that proposals for the public lighting of that place, for a term of five years, by means of arc lights, will be received up to 6 P. M. of October 17th. The bids are to be based on a candle power of 2,000 and 1,200, respectively; also, for an all night service and a moontable service.

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The Newport (R. I.) Gas Light Company has purchased the Burdick-Stedman plot of land. This gives it a space of 175 feet by 79 feet for future extensions to the works, which latter may be looked for shortly.

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The Consolidated Gas Improvement Company, of this city, has arranged to construct a gas works at Haverstraw, N. Y., in which the Elkins-Boeklen type of gas making will be followed. The Company proposes to distribute both fuel and illuminating gases, through separate main pipes; and its main object is the attempt to supply fuel gas on a large scale to the baking plants of the great brick making establishments that have made the Village of Haverstraw famous throughout the States. Messrs. Osborne & Williams, who had the original franchise for a gas works at Haverstraw, are in sympathy with the efforts of the Elkins-Boeklen promoters. Mr. I. S. Elkins is President of the Consolidated Gas Improvement Company.

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The New Bedford Boiler Company has the contract for erecting at the new power house of the New Bedford Gas Light Company an iron chimney or stack, the dimension of which is 5 feet in diameter, by 65 feet in height.

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Messrs Rogers and Williams, who so ably manage the U. G. I. Company's Paterson (N. J.) gas properties, no doubt prompted by the success that attended their plan of introducing gas cookers this season, are making persistent efforts to place gas heaters for the winter season. It is also satisfactory to note that they are beginning with the "primer sizes," such, for instance, as bathroom warmers, etc.

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The Worcester (Mass.) *Telegram*, of recent date, gives the following interesting particulars respecting the settlement of the damages cases against the Worcester Gas Light Company, said cases having resulted from the unfortunate happening at the works on May 16, 1891 (a report of which will be found in the Journal for May 25, 1891): "The case of James and Mary Hamilton, the latter a resident of Ireland, against the Worcester Gas Light Company, pending in the Superior Court, was settled on September 26th by the parties out of Court; judgment being entered for the plaintiffs for $1,750 and the judgment satisfied. The case was one of tort to recover $5,000 damages for the death of Patrick Hamilton, while in the plaintiff's employ, May 16, 1891. On that day there was an accident at the works of the Gas Company, resulting in the death of Michael McNamara and Patrick Hamilton, by suffocation from escaping gas, and injuring several others. Suits were subsequently brought by the administrators of the estates of McNamara and Hamilton, and that of the former was settled before it was entered in Court. The Employers Liability Company, of Boston, defended both actions, and offered $1,000 in each case to settle. The offer was refused by counsel for the Hamilton heirs at the time, and the case hung fire until the last term of Court, when it was on the list for trial. The law was examined by F. P. Goulding, at the request of plaintiff's counsel, and they saw there was not a big chance of recovering large damages, because it could not be shown how much the plaintiffs, who are next of kin, depended on the deceased for support. If they received but little support from him, it was considered doubtful if they could have recovered as much as the Gas Company offered in settlement of the case. Finally, the counsel for the Employers' Liability Company and the Gas Company attorneys offered $1,750 in full settlement of the case, and the offer was accepted by the plaintiff's lawyers."

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The people of Watertown, Mass., are up in arms against the policy of the authorities in following a moontable for the street lighting, and we agree with them that the place is a trifle too thickly inhabited to go along now in the rut that "would do" a score of years ago. In the meantime the Newton and Watertown Gas and Electric Light Company stands ready to keep the lights in service each night and every night.

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We might also remark that the argument in Minneapolis, Minn., as to whether or not an all night and every night service shall prevail there in respect of the gas lamps maintained on the public streets is likely to be decided in favor of the modern practice.

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The Citizens Gas Light Company, of Reading and Wakefield, Mass., has offered to dispose of its plant to the authorities of Wakefield for the sum of $200,000. This offer, of course, is a sequence to the attempt by the authorities of Wakefield, Mass., to engage in the operation of a lighting plant on municipal account.

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Director Windrim, of the Philadelphia City Gas Department, is earnest in his advocacy of the proposition to oblige each department of the city's management to pay for the gas consumed in the different buildings, etc., under control of the different "bureaus." Until such a course is pursued, the ordinary gas consumer will have an unduly heavy burden to carry in the gas charges that he is required to pay in lighting up his home, shop or factory. Last year the different departments consumed the tremendous quantity of 587½ millions cubic feet of gas—an increase over the quantity so consumed in 1891 just short of 40 millions cubic feet.

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Another claimant for a gas franchise at Manchester, Va., has appeared in the shape of the Southern Fuel and Gas Company, the headquarters of which are in Richmond, Va, We had something to say about this Company and its process in our issue dated September 19th.

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The Reading (Pa.) *Telegram* recently printed the following respecting the history and doings of the Consumers Gas Company, of that city:

The contract for the erection of Reading's gas plant was let in 1848, and was erected by Battin, Dungan & Co., for the incorporators of the Reading Gas Company, who were Dr. Isaac Heister, M. Richards, Dr. H. H. Muhlenberg, J. L. Stichter, Robert W. Packer, Samuel Bell, Benneville Keim, E. B. Hubley, William Darling, J. Glancey Jones, John Ritter and Samuel Griscom. The laying of the corner stone was

attended with Masonic ceremonies, and the original plant consisted of the gas manufacturing plant proper, 5 miles of mains and pipes, 30 street lamps and a single lift holder of 40,000 feet capacity. The Company was well patronized, and the capacity was increased from time to time until in 1885 there were 2,600 meters in use, 46 miles of main pipe and a capacity of 300,000 cubic feet of gas per day. In November of that year the Consumers Gas Company leased the plant, and at once instituted and brought to full fruition improvements that have proven wonderful. The plant was entirely remodeled, the process of manufacturing was improved, the works were enlarged, the candle power increased, the price to consumers was cheapened, and as a result the capacity is now 800,000 cubic feet of gas per day. Three immense holders of 500,000 feet of total capacity have been erected. More than 60 miles of mains have been laid and there are almost 5,000 meters in use. Among the many public buildings in this city using it are all the hotels, the theaters and other places of amusement, and most of the stores, and it is almost universally used in residences throughout the city. It is giving general and universal salisfaction as an illuminant, both as to price and the quality of light given and is fast becoming recognized as the best fuel for cooking purposes. The present management of the Consumers' Gas Company is Henry Baumgardner, President; John H. Keppelman, Secretary and Superintendent; Edward C. Lee, Treasurer. The General Manager is S. T. Bodine, and the Directors are Henry Baumgardner, E. C. Lee, Samuel T. Bodine, Wayne McVeagh and Richmond L. Jones. The recent success of the Company here, while to a large extent the result of the superior quality of the gas, is also largely attributable to the energy and admirable business management of John H. Keppelman, the Superintendent. He is a live, energetic business man, who is always in the vanguard of movements looking to the upbuilding and growth of the city of Reading."

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THE contract for lighting the village of South Orange, N. J., has been awarded to the Citizens' Gas Light Company, of Newark. The agreement, which is to run for two years and six months, calls for the maintenance of not less than 200 gas lamps, at the rate of $20 per lamp per year. Under the old contract 300 lamps were maintained, but the Trustees reserve the right now to replace 100 lamps with electric arcs.

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ON and after the 17th inst., the Brookline Gas Light Company, of Brookline, Mass., will operate from its electric annex a day circuit of 2,000 volts alternating current. The alternating current wires will be tagged to show that they are "live wires."

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A PETITION from the employees of the Philadelphia gas works for an increase in their wages is under consideration by the Gas Bureau.

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## The Production of Heating Gas and Ammonia.

Our issue for January 11, 1892 (pp. 43, 44), contained an article by Mr. Alphonse Hennin on the production of ammonia, tar and heating gas, and recently the author has prepared a paper on somewhat similar lines. In his latest reference to the subject, Mr. Hennin says:

In the dry distillation of coal, the production of ammonia does not exceed 10 per cent. of the total nitrogen, being limited by the water of combination of the coal. This conclusion is corroborated by the fact that in blast furnaces where raw coal is used, although all the coal is consumed, and consequently all the nitrogen is liberated, the product of ammonia does not exceed 15 per cent. of the total nitrogen. In addition to the water of combination in the coal, there is doubtless also a proportionate effect, due to the water of combination of the iron ore and flux, perhaps slightly influenced by traces of water carried into the furnace with the air blast.

If all the nitrogen in coal could be converted into ammonia, a coal containing 1¼ per cent. of nitrogen would produce per ton the equivalent of 164 pounds of sulphate of ammonia. This result is not obtainable in blast furnaces; it is impossible in the manufacture of illuminating coal gas or coke; but it is realizable to a large extent in the manufacture of heating gas for metallurgical and other uses.

The nascent hydrogen from the water of combustion of the coal is the main element which accomplishes the transformation of the nitrogen into ammonia. Hence, the more water the more ammonia. If a sufficient outside supply of water is given, all the other conditions being favorable, the total amount of the nitrogen may be secured as ammonia. Practice has demonstrated the correctness of this view. As has been pointed out, the main conditions for the formation of ammonia are eminently favorable to the production of a good heating gas. But high temperature is not compatible with a large excess of steam unless the latter be intensely superheated; and such a temperature cannot be maintained for any considerable time without an outside supply of oxygen or an expensive external heating. Moreover, steam in large excess is liable to produce a gas very high in carbon dioxide, and hence of comparatively little calorific value. Nor should it be forgotten that ammonia, under favorable conditions, is decomposed at a temperature far below that which is required to decompose water and reduce the carbon dioxide into carbon monoxide. The practical operation, therefore, must be so conducted as to maintain the proper heat, make the conditions for the decomposition of ammonia as unfavorable as possible, and, at the same time, produce such a gas as is required in the metallurgy of iron and steel where rapidity of heating and melting, with the lowest percentage of waste, is a prime consideration.

I have found that when high pressure steam is moderately superheated and evenly distributed and diffused in the glowing mass, a limited supply of air, drawn into the generator, is sufficient to maintain the temperature needed to admit continuously from 1 and 1¼ pounds of high pressure steam to the pound of coal, and that this proportion of steam is ample to provoke the necessary reactions which transform into ammonia 50 to 60 per cent. of the total nitrogen of the coal, and still to produce a gas of the following composition:

| | Per cent. |
|---|---|
| Carbon dioxide | 10.50 |
| Oxygen | 1.00 |
| Carbon monoxide | 20.00 |
| Methane and homologous compounds | 4.50 |
| Hydrogen | 38.00 |
| Nitrogen | 26.00 |
| | 100.00 |

This gas is rather high in carbon dioxide, but the total of combustible matter is considerable, and the efficiency of the gas in a regenerative furnace for heating iron is very great. It burns with a sharp, white-bluish flame, and without luminosity, and heats more rapidly and more economically than the ordinary Siemens gas.

It would seem, at first glance, that the admission of 1 to 1.75 pounds of steam to the pound of coal would have a high cooling effect, hindering the steady production of a gas of the above composition, if the carbon is taken as the only source of heat. Practice shows, however, that such is not the case. * * The danger of the dissociation of the ammonia is not as great in practice as has been anticipated. If we remember in what infinitesimal proportion the ammonia is present, diluted, and hence practically protected by the other gases, it is evident that the chance for decomposition, with ordinary care, is very small. And if the product is instantaneously exhausted from the hot atmosphere, carried into the cooler zone immediately above, and led out through green fuel on the top, the ammonia is secured.

With well devised producers and the proper plant, when the art of managing and controlling the heat in the different zones of the fuel bed has been mastered, there is no difficulty in producing regularly, with the proper amount of steam, from each ton of coal, 70 to 80 pounds of sulphate of ammonia; 130,000 to 150,000 cubic feet of heating gas of high quality; and, in addition, some 15 to 20 gallons of tar, according to the nature of the coal. The generator must be perfectly accessible, so that it may be easily cleaned, and the coal may be perfectly broken through. The aim should be to keep the fuel like a sponge, but without holes or cavities. The advantages of a good stirring are obvious, it insures the complete diffusion of the steam through the glowing mass, maintains the high temperature in the lower part of the generator, and keeps the top cool, thus tending to secure economy in coal, the minimum of necessary cooling surface in the condensers, and the maximum yield of ammonia. The carbon dioxide should be kept at a minimum. Its formation is a function of temperature; the lower the temperature at which the carbon and air or the carbon and steam come in contact, the more carbon dioxide is formed. It must not be forgotten that the depth of the fuel has a very important bearing on the conditions and results. In order to obtain good heating gas and the largest yield of ammonia and tar, the gas must be well cooled and well scrubbed. If the gas be not cooled, the quantity of water which it will suck from the washing apparatus is so great as to destroy the value of the gas for heating purposes, while the ammonia, even if it be in the form of fixed salt or sulphate, is carried away, and the more volatile constituents of the tar are carried forward and settle in the conduits. The system is entirely smokeless, and has the further advantage of taking the sulphurous acid very thoroughly out of the gas.

## The Market for Gas Securities.

In city gas shares the market early in the week was uneven, and inclined to weakness, although at the close—or up to noon of Friday—the tone was stronger in consequence of sharp inquiry for almost all classes of gas shares at the quoted reduction in prices. Consolidated in fact closed an eighth above the bid price for a week ago, having opened to-day at 115⅝ to 115¾. Equitable was steady, while Mutual was reported at 140 to 143, although we believe this quotation does not represent anything denoting important weakness. Intrinsically, the shares are worth as much now as they ever were. Standard, as to both classes, shows no change.

Brooklyn shares are strong and steady, although some of the bears are doing their best to discredit the market value of the Equity Company's bonds. It is reported that one prominent broker in Brooklyn recently offered a block of Equity construction stock at a price well under its real value, but when the offer was promptly taken he pleaded the baby act—that is, he had made a mistake as to the price asked by the holder. The legal proceedings to set aside the Equity Company's charter are not worth considering, save for the trouble they have occasioned the Company's proprietors. The old receivership dodge in Chicago gas was worked again on Friday last, but this time the "dodgers" seem to have made quick contact with a blind wall. It is presumed they put out a goodly line of shorts, and it is to be hoped they did, for to-day's opening (Friday) witnessed sales at 85. Our figure of par for this stock is sure to be reached before the formal opening of the Fair. After that it may be different. Laclede, both common and preferred, is strong and higher. The U. G. I. Company has declared a quarterly dividend of 2 per cent. ($1 per share), payable October 15th. Baltimore Consolidated is steady, at 59⅛ to 59⅜, and there is no change in Bay State securities.

## Gas Stocks.

**Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,**

16 Wall St., New York City.

October 10.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

| | Capital. | Par. | Bid | Asked |
|---|---|---|---|---|
| Consolidated | $35,430,000 | 100 | 115⅝ | 115¾ |
| Central | 500,000 | 50 | 90 | 95 |
| " Scrip | 220,000 | — | — | 100 |
| Equitable | 4,000,000 | 100 | 154 | 156 |
| " Bonds | 1,000,000 | — | 106 | 108 |
| Harlem, Bonds | 170,000 | — | — | — |
| Metropolitan, Bonds | 658,000 | — | 110 | 115 |
| Mutual | 3,500,000 | 100 | 149 | 143 |
| " Bonds | 1,500,000 | — | 100 | 102 |
| Municipal, Bonds | 750,000 | | — | — |
| Northern | | 50 | — | — |
| " Bonds | 150,000 | — | — | 100 |
| Standard Gas Co— | | | | |
| Common Stock | 5,000,000 | 100 | 35 | — |
| Preferred | 5,000,000 | 100 | — | 85 |
| Yonkers | | 50 | 112 | — |
| Richmond Co., S. I. | 346,000 | 50 | — | — |
| " Bonds | 20,000 | — | — | — |
| Gas Co's of Brooklyn. | | | | |
| Brooklyn | 2,000,000 | 25 | 135 | 140 |
| Citizens | 1,200,000 | 20 | 113⅝ | 113⅞ |
| " S. F. Bonds | 320,000 | 1000 | — | 103 |
| Equity Gas Light Co | 2,000,000 | 100 | 37 | — |
| Bonds | 1,000,000 | — | — | 85 |
| Fulton Municipal | 3,000,000 | 100 | 142 | 145 |
| " Bonds | 300,000 | | 102 | — |
| Peoples | 1,000,000 | 10 | 92 | 95 |
| " Bonds (7's) | 368,000 | — | 100 | — |
| " " (6's) | 94,000 | — | 100 | — |
| Metropolitan | 870,000 | 100 | 117 | 120 |
| " Bonds (5's) | 70,000 | — | 100 | — |
| Nassau | 1,000,000 | 25 | 150 | — |
| " Ctfs | 700,000 | 1000 | 99 | 100 |
| Williamsburgh | 1,000,000 | 50 | 135 | — |
| " Bonds | 1,000,000 | — | 107 | 110 |
| Out of Town Gas Companies. | | | | |
| Boston United Gas Co.— | | | | |
| 1s Series S.F. Trust | 7,000,000 | 1000 | 87 | 88 |
| 2d " " " | 3,000,000 | 1000 | 75 | 75½ |
| Bay State Gas Co.— | | | | |
| Stock | 5,000,000 | 50 | 59 | 59½ |
| Income Bonds | 2,000,000 | 1000 | 77 | 78 |
| Buffalo Mutual, N. Y. | 750,000 | 100 | 110 | — |
| " Bonds | 200,000 | 1000 | 95 | 100 |
| Citizens, Newark | 1,000,000 | 50 | 155 | 160 |
| Chicago Gas Company. | 25,000,000 | 100 | 85 | 87 |
| Chicago Gas Light & Coke Co.— | | | | |
| G't'd Gold Bonds | 7,650,000 | 1000 | 85 | 90½ |
| Equitable Gas & Fuel Co, Chicago, Bonds | 2,000,000 | 1000 | — | 101 |
| People's Gas and Coke Co., Chicago— | | | | |
| 1st Mortgage | 2,100,000 | 1000 | 103 | — |
| 2d " | 2,500,000 | 1000 | 103 | — |
| Consumers Gas Light Co., Jersey City | 2,000,000 | 100 | 20 | — |
| Bonds | 600,000 | 1000 | 80 | — |
| Cincinnati G. & C. Co. | 7,000,000 | 100 | 192 | — |
| Consumers Toronto | 1,600,000 | 50 | 190 | 191 |
| Central, S. F., Cal | | | 90 | — |
| Capital, Sacramento, Cal | | | 55 | — |
| Consolidated, Balt. | 11,000,000 | 100 | 59⅛ | 59⅜ |
| " Bonds | 6,400,000 | | 107 | 107½ |
| Citizens Gas Lt. Co., Rochester, N. Y. | 500,000 | — | 85 | 101 |
| Bonds | 250,000 | | — | — |
| East River Gas Co., Long Island City | 1,000,000 | 100 | 100 | 105 |
| Bonds | 500,000 | 100 | 100 | 102 |
| Hartford, Conn | 750,000 | 25 | 120 | 128 |
| Jersey City | 750,000 | 20 | 180 | 200 |
| Laclede Gas Light Co., St. Louis, Mo.— | | | | |
| Common Stock | 7,500,000 | 100 | 24 | 24¼ |
| Preferred " | 2,500,000 | 100 | 65¾ | 66 |
| Bonds | 9,034,400 | 1000 | 84 | 84½ |
| Louisville, Ky | 2,570,000 | 50 | 125 | 130 |
| Little Falls, N. Y. | 50,000 | 100 | — | 100 |
| " Bonds | 25,000 | — | 100 | 103 |
| Montreal, Canada | 2,000,000 | 100 | 200 | 208 |
| Memphis (Tenn.) Gas | 750,000 | 100 | 40 | — |
| " Bonds | 240,000 | 100 | 103 | — |
| New Haven, Conn | | 25 | 200 | — |
| Oakland, Cal | | | 39 | — |
| Peoples, Jersey City | | — | 115 | 125 |
| " " Bonds | | | — | — |
| Paterson, N. J | | 25 | 99 | 102 |
| Rochester, N. Y | | 50 | 99 | 100 |
| Syracuse, N. Y | 500,000 | 25 | — | — |
| San Francisco Gas Co. San Francisco, Cal. | 10,000,000 | 100 | 71 | 71½ |
| Washington, D. C | 2,000,000 | 20 | 200 | 208 |
| Wilmington, Del. | | 50 | 88 | 90 |

# Advertisers Index.

### GAS ENGINEERS.


Jos. R. Thomas, New York City ... 537
Wm. Henry White, New York City ... 535
Fred. Bredel, New York City ... 531
H. C. Slaney, New York City ... 537
Frederic Egner & Co., St. Louis, Mo ... 528


### CHEMISTS.


Durand Woodman, New York City ... 537


### PROCESSES.


National Gas Light and Fuel Co., Chicago, Ills ... 536
Bartlett, Hayward & Co., Baltimore, Md ... 533
United Gas Improvement Co., Phila, Pa ... 535
Burdett Loomis, Hartford, Conn ... 535
National Gas and Water Co., Chicago, Ills ... 527


### GAS WORKS APPARATUS AND CONSTRUCTION.


James R. Floyd & Sons, New York City ... 535
Continental Iron Works, Brooklyn, N. Y ... 530
Deily & Fowler, Phila., Pa ... 535
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 532
Stacey Mfg. Co., Cincinnati, Ohio ... 535
Bartlett, Hayward & Co., Baltimore, Md ... 533
Morris, Tasker & Co., Limited, Phila., Pa ... 533
Davis & Farnum Mfg. Co., Waltham, Mass ... 532
R. D. Wood & Co., Phila., Pa ... 534
Bouton Foundry Co., Chicago, Ills ... 535
Isbell-Porter Company, New York City ... 534
Fred. Bredel, New York City ... 531
United Gas Improvement Co., Phila., Pa ... 535
National Gas Light and Fuel Co., Chicago, Ills ... 536
Berlin Iron Bridge Company East Berlin, Conn ... 522
National Gas and Water Co., Chicago, Ills ... 527
The Gas Works Construction Co., New York City ... 519
Frederic Egner & Co., St. Louis, Mo ... 528


### GAS AND WATER PIPES.


Mellert Foundry and Machine Co., Reading, Pa. (John Fox, Selling Agent, N. Y.) ... 529
Ohio Pipe Co., Columbus, Ohio ... 529
M. J. Drummond, New York City ... 529
R. D. Wood & Co., Phila., Pa ... 534
Warren Foundry & Machine Co., New York City ... 529
Donaldson Iron Co., Emaus, Pa ... 529
Addyston Pipe and Steel Co, Cincinnati, O ... 529
Detroit Pipe and Foundry Co., Detroit, Mich ... 529


### ELEVATORS, CONVEYORS, ETC.


Link-Belt Machinery Co ... 519


### STEAM BLOWER FOR BURNING BREEZE.


H. E. Parson, New York City ... 522


### GAS COALS.


Penn Gas Coal Co., Phila., Pa ... 537
Perkins & Co., New York City ... 536
Despard Coal Coal, Baltimore, Md ... 537
Chesapeake and Ohio R. R. Coal Agency, N. Y. City ... 537
Westmoreland Coal Company, Phila., Pa ... 537
J. & W. Wood, New York City ... 536


### CANNEL COALS.


Perkins & Co., New York City ... 536
J. & W. Wood, New York City ... 536


### GAS ENRICHERS.


Standard Oil Co., Cleveland, Ohio ... 537


### COKE CRUSHER.


C. M. Keller, Columbus, Ind ... 536


### INCLINED RETORTS.


Parker-Russell Mining and Mfg. Co., St. Louis, Mo ... 530


### RETORTS AND FIREBRICK.


J. H. Gautier & Co., Jersey City, N. J ... 530
B. Kreischer & Sons, New York City ... 530
Adam Weber, New York City ... 530
Laclede Fire Brick Mfg. Co, St. Louis, Mo ... 530
Brooklyn Retort and Fire Brick Works, Brooklyn, N. Y ... 530
Borgner & O'Brien, Phila., Pa ... 530
James Gardner, Jr., Pittsburgh, Pa ... 530
Henry Maurer & Son, New York City ... 530
Baltimore Retort and Fire Brick Co., Baltimore, Md ... 530
Parker-Russell Mining and Mfg. Co., St. Louis, Mo ... 530


### COMPTOMETERS.


Felt & Tarrant Mf'g. Co., Chicago, Ills ... 519


### GASHOLDER TANKS.


W. C. Whyte, New York City ... 526
J. P. Whittier, Brooklyn, N. Y ... 524


### GASHOLDER PAINT.


The Government Waterproof Paint Co., Boston, Mass ... 522


### CEMENTS.


C. L. Gerould & Co., Brooklyn, N. Y ... 530


### SCRUBBERS AND CONDENSERS.


G. Shepard Page's Sons, New York City ... 488
R. D. Wood & Co., Phila., Pa ... 534
James R. Floyd & Sons, New York City ... 528
Continental Iron Works, Brooklyn, N. Y ... 530


### REGENERATIVE FURNACES.


Bartlett, Hayward & Co., Baltimore, Md ... 533
Fred. Bredel, New York City ... 531
J. H. Gautier & Co., Jersey City, N. J ... 531
Parker-Russell Mining and Mfg. Co., St. Louis, Mo ... 530

**GAS GOVERNORS.**

Connelly Iron Sponge and Governor Co., New York City.... 527
Wilbraham Bros., Phila., Pa..... 527

**TAR AND CARBONIC ACID EXTRACTOR.**

Geo. Shepard Page's Sons, N. Y. City..... 524

**COAL TAR.**

J. W. Ford, Chicago, Ill..... 519

**AMMONIA CONCENTRATOR.**

Michigan Ammonia Works, Detroit, Mich..... 519

**GAS METERS.**

John J. Griffin & Co., Phila., Pa..... 538
American Meter Co., New York and Philadelphia..... 539
The Goodwin Meter Co., Philadelphia, Pa..... 540
Helme & McIlhenny, Phila., Pa..... 539
D. McDonald & Co., Albany, N. Y..... 539
Nathaniel Tufts, Boston, Mass..... 538
Maryland Meter and Manufacturing Co., Baltimore, Md.... 538
Harris Bros. & Co., Philadelphia, Pa..... 538
Keystone Meter Co., Royersford, Pa..... 539

**COUPON CUTTERS.**

Felt & Tarrant Mf'g. Co., Chicago, Ills..... 519

**SELF-SEALING MOUTHPIECE DOORS.**

Isbell-Porter Company, New York City..... 534
Continental Iron Works, Brooklyn, N. Y..... 530

**BURNERS.**

C. A. Gefrorer, Phila., Pa..... 529
Moses G. Wilder, Phila., Pa..... 519
Non-Corrosive Gas Tip Co., Boston, Mass..... 483

**STREET LAMPS.**

J. G. Miner, Morrisania, New York City..... 531
Bartlett Street Lamp Mfg. Co., New York City..... 531

**PURIFYING MATERIAL.**

Connelly Iron Sponge and Governor Co., New York City... 527
Greenpoint Chemical Works, Brooklyn, N. Y..... 527
Henry W. Douglas, Ann Arbor, Mich..... 527

**ELECTRICAL APPARATUS.**

Wm. Henry White, N. Y. City..... 535
Fort Wayne Electric Co., Fort Wayne, Ind..... 411

**EXHAUSTERS.**

The P. H. & F. M. Roots Co., Connersville, Ind..... 524
Isbell-Porter Company, New York City..... 534
Wilbraham Bros., Philadelphia, Pa..... 527
Connelly Iron Sponge and Governor Co., New York City.... 527

**VALVES.**

Ludlow Valve Manufacturing Co., Troy, N. Y..... 529
Chapman Valve Manufacturing Co., Boston, Mass..... 529
R. D. Wood & Co., Phila., Pa..... 534
The P. H. & F. M. Roots Co., Connersville, Ind..... 488
Continental Iron Works, Brooklyn, N. Y..... 530

**GAS ENGINES.**

Schleicher, Schumm & Co., Phila., Pa..... 504

**ENGINES AND BOILERS.**

The Hazelton Boiler Co., New York City..... 521

**PURIFIER SCREENS.**

John Cabot, New York City..... 529

**GAS STOVES.**

American Meter Co., New York and Philadelphia..... 523
The Goodwin Meter Co., Phila., Pa..... 540
George M. Clark & Co., Chicago, Ills..... 521
Maryland Meter and Manufacturing Co., Baltimore, Md.... 538
The Schneider & Trenkamp Co., Cleveland, O..... 520

**BOOKS, ETC.**

1892. Directory. 1892..... 524
King's Treatise..... 530
American Gas Engineer and Superintendents' Handbook... 531
Fuel and its Applications..... 522



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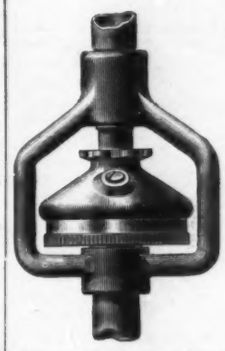

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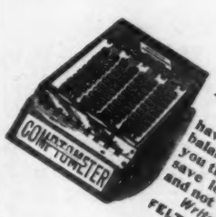


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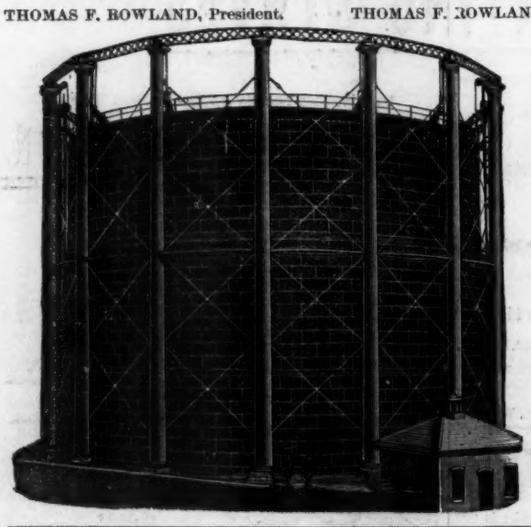

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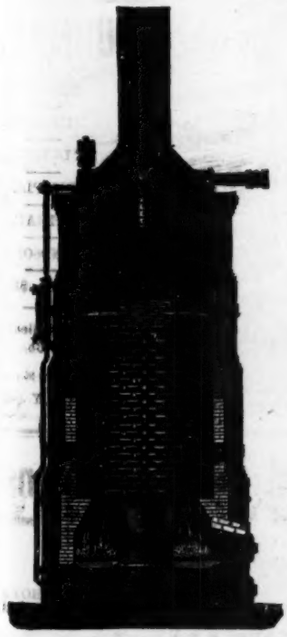

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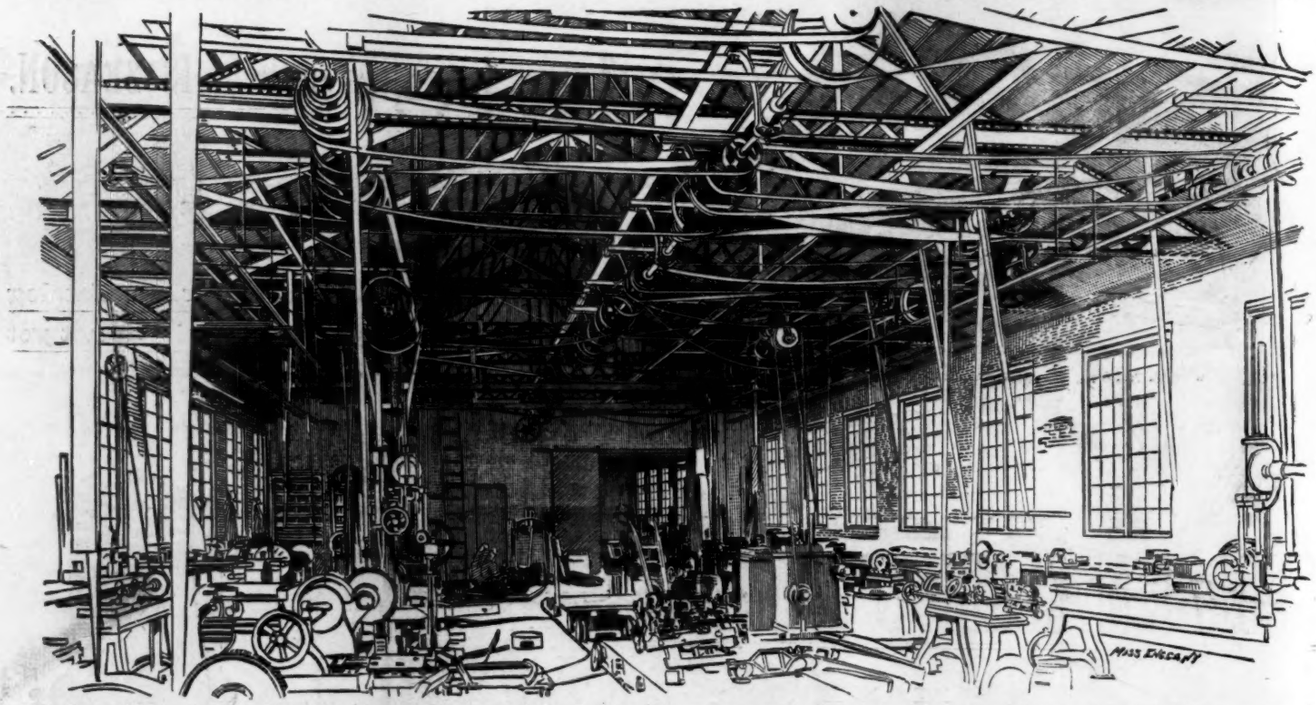

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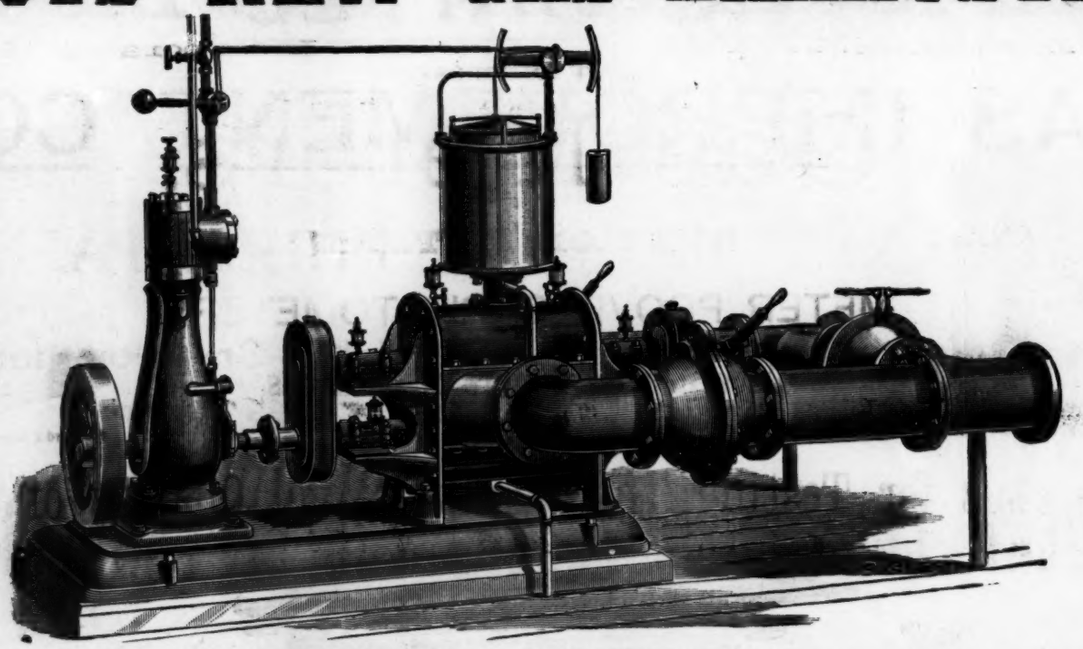

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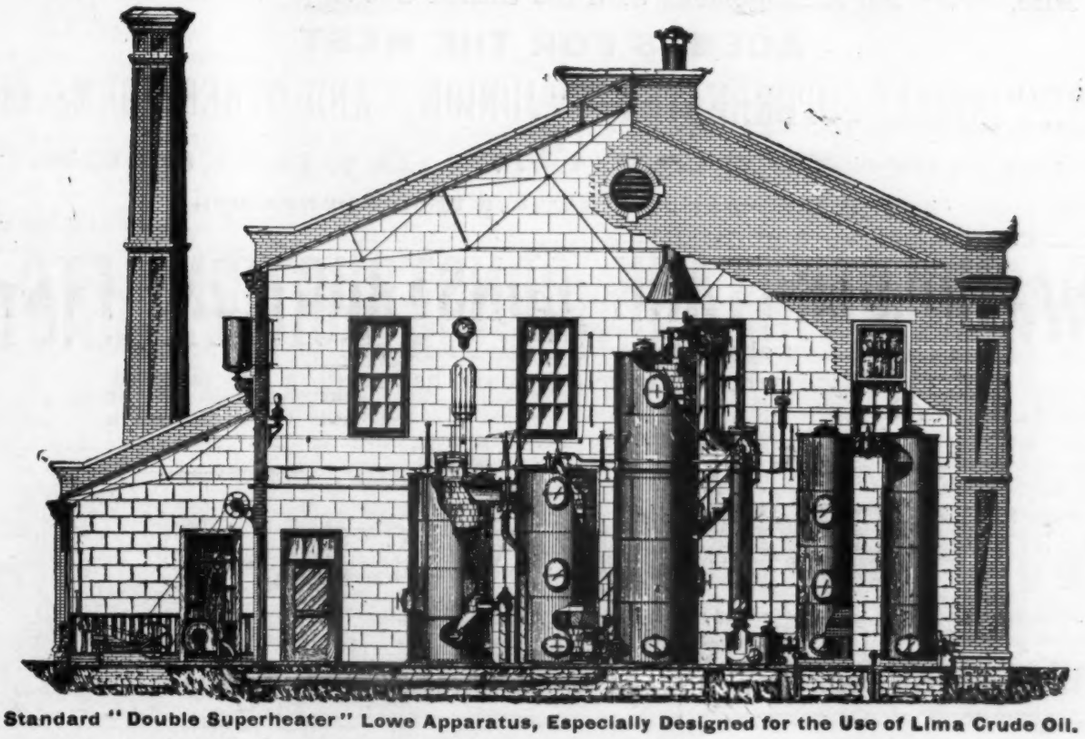

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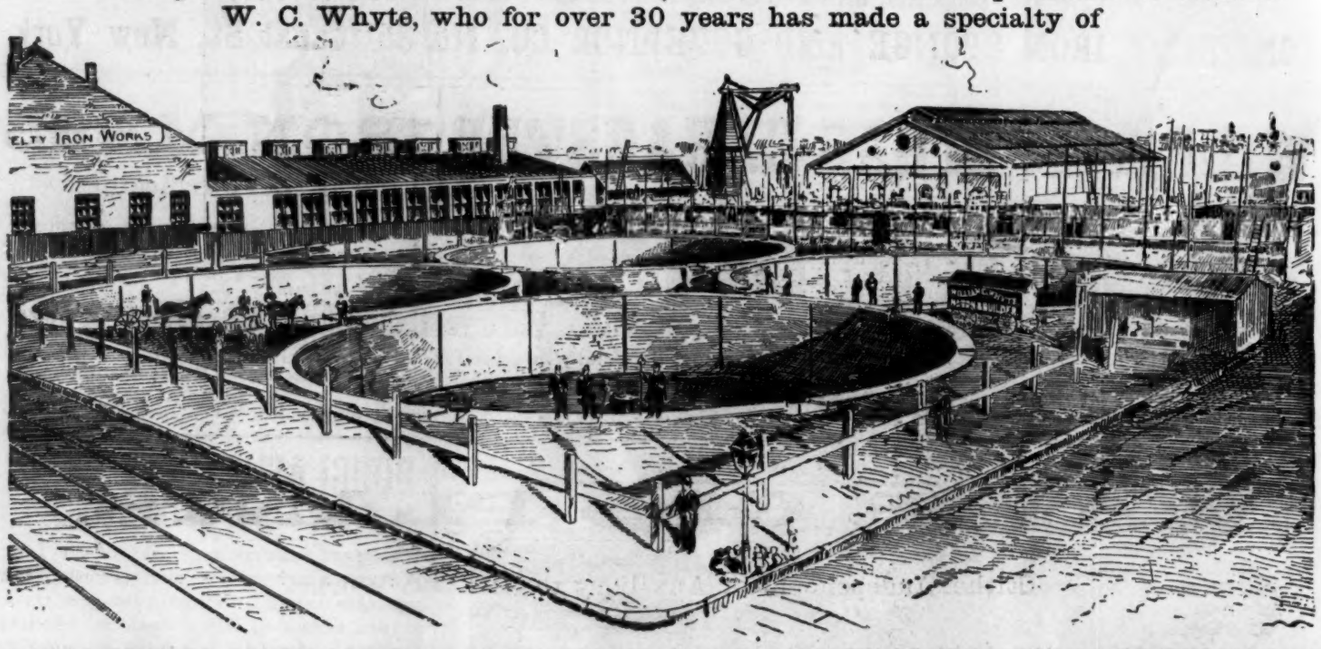


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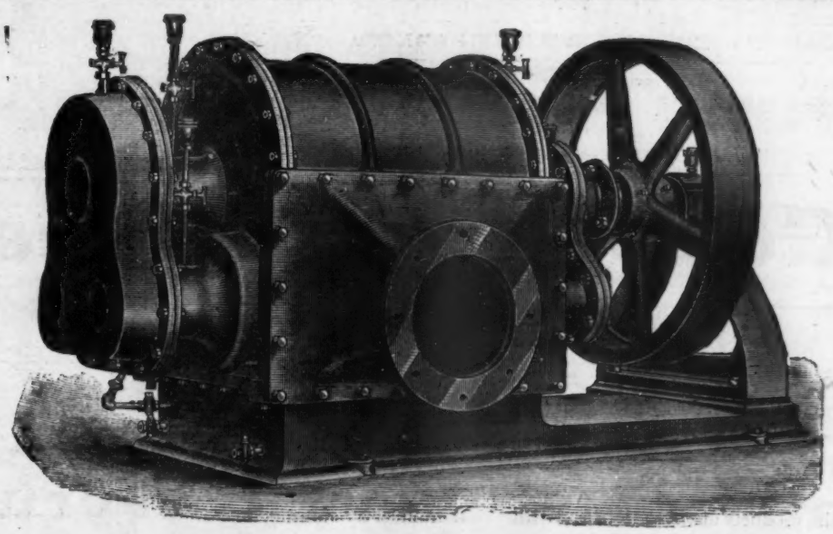

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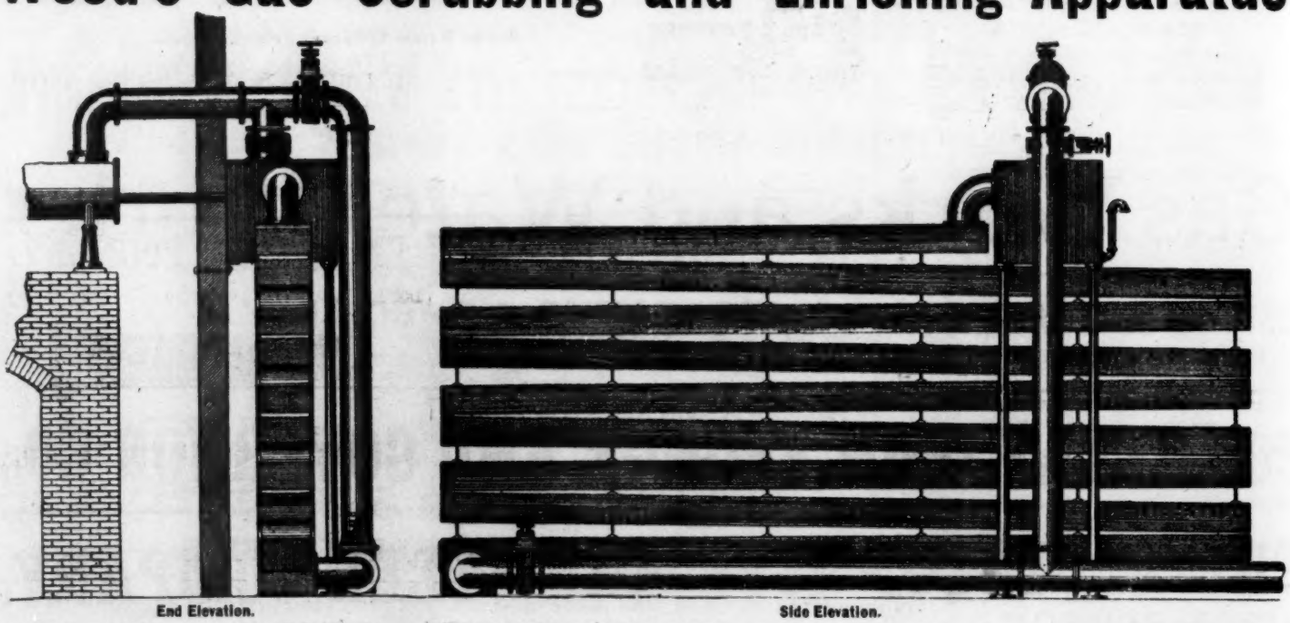

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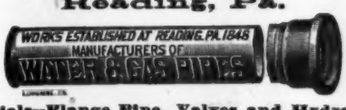


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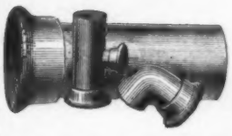

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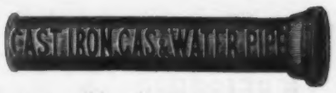


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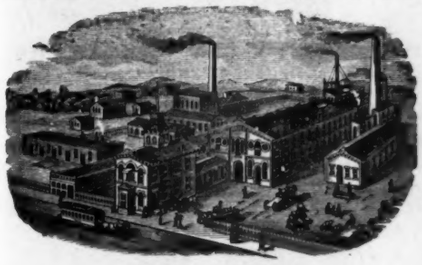

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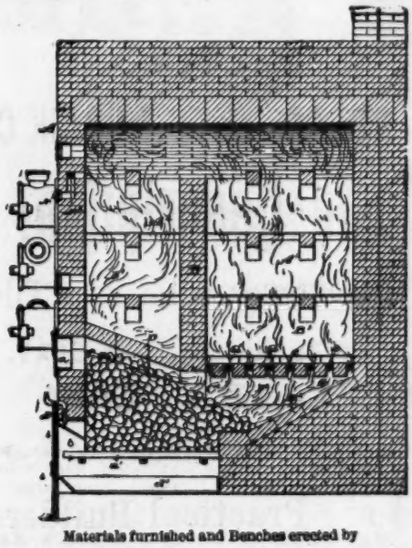

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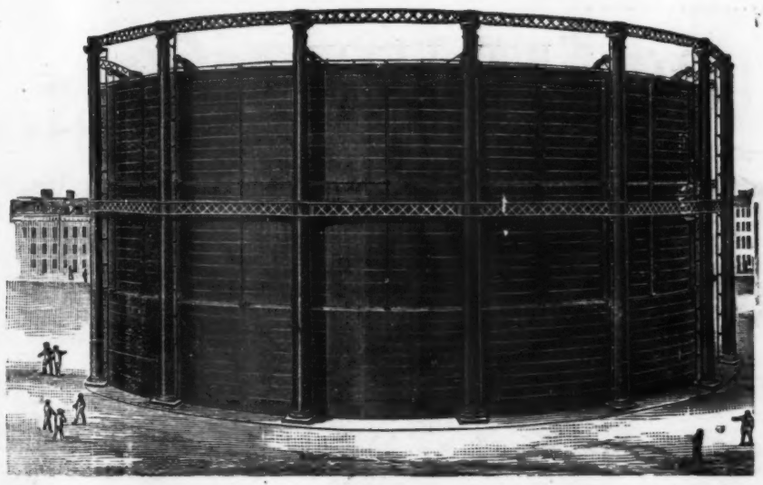

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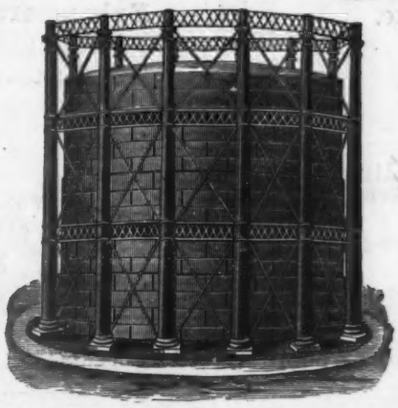

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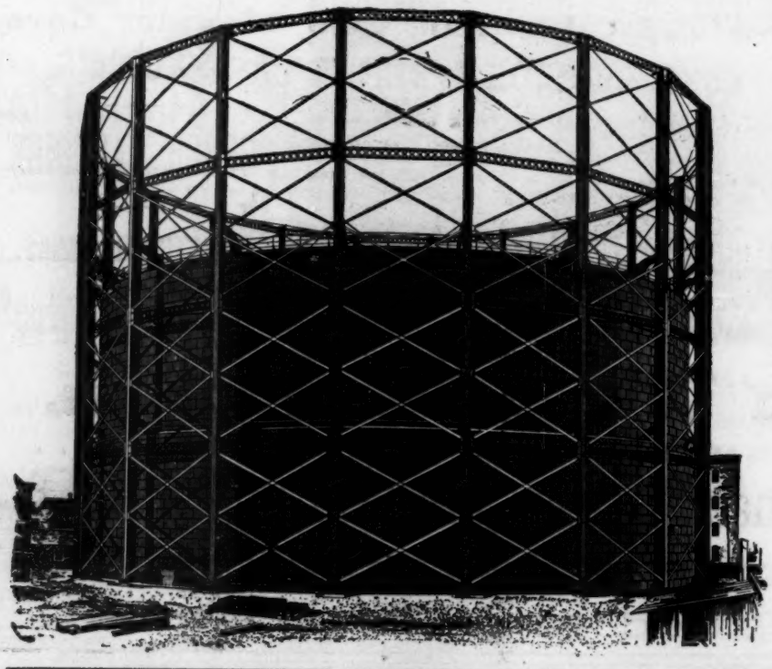

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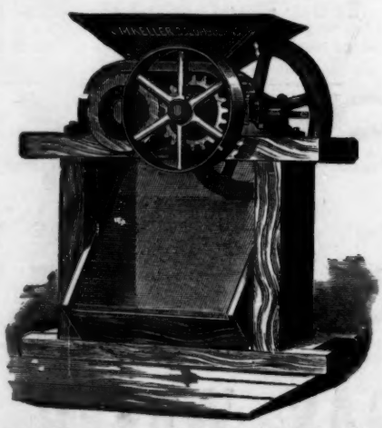

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| | SIZE. | | |
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| *Stove.* | *Oven.* | *Broiler.* | *Top.* |
| 31 inches high. | 9¼ inches high. | 10 inches high. | 21 inches high. |
| 17 inches wide. | 15 inches wide. | 15 inches wide. | 16 inches wide. |
| | 12½ inches deep. | 12½ inches deep. | |
| | Length over extension shelves, 32 inches. | | |

This Stove has three Boiling Burners in the Top or Hot Plate, and single Oven Burner.

The consumption of this Stove is 35 cubic feet per hour, at 1½ inch pressure with all burners.

Three-eighth inch supply pipe should be used when the pressure is 1½ inches or over.

ALL FITTINGS ARE NICKEL PLATED.

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